GROUP 11C

ENGINE MECHANICAL <4G1>

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GENERAL INFORMATION

M1111000100828

Item		4G15
Total displacement mL		1,468
Bore × Stroke mm		75.5 × 82.0
Compression ratio		9.0
Compression chamber		Pentroof
Camshaft arrangement		DOHC
Number of valve	Intake	8
	Exhaust	8
Valve timing	Intake opening	BTDC 34° – ATDC 6°
	Intake closing	ABDC 30° – ABDC 70°
	Exhaust opening	BBDC 50°
	Exhaust closing	ATDC 10°
Fuel system		Electronically controlled multipoint fuel injection
Rocker arm		Roller type
Auto-lash adjuster		Equipped

SERVICE SPECIFICATIONS

M1112000300795

Item		Standard value	Limit
Alternator drive belt tension (When checked)	Vibration frequency Hz	218 – 266	–
	Tension N	392 – 588	–
	Deflection mm (Reference)	6.2 – 8.0	–
Alternator drive belt tension (When adjusted)	Vibration frequency Hz	231 – 255	–
	Tension N	441 – 539	–
	Deflection mm (Reference)	6.6 – 7.5	–
Alternator drive belt tension (When replaced)	Vibration frequency Hz	308 – 344	–
	Tension N	785 – 981	–
	Deflection mm (Reference)	4.1 – 5.0	–
A/C compressor drive belt tension (When checked)	Vibration frequency Hz	165 – 213	–
	Tension N	294 – 490	–
	Deflection mm (Reference)	8.9 – 11.2	–
A/C compressor drive belt tension (When adjusted)	Vibration frequency Hz	179 – 203	–
	Tension N	343 – 441	–
	Deflection mm (Reference)	9.3 – 10.7	–

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Item		Standard value	Limit
A/C compressor drive belt tension (When replaced)	Vibration frequency Hz	213 – 253	–
	Tension N	490 – 686	–
	Deflection mm (Reference)	6.6 – 8.6	–
Basic ignition timing		5° BTDC ± 3°	–
Ignition timing		Approximately 10° BTDC	–
Idle speed r/min		750 ± 50	–
CO contents %		0.5 or less	–
HC contents ppm		100 or less	–
Compression pressure kPa-r/min		1,210 – 300	830 – 300
Compression pressure difference of all cylinders kPa		–	Maximum 98
Intake manifold vacuum kPa		–	Minimum 60
Cylinder head bolt nominal length mm		–	103.2
Timing belt tensioner adjuster rod protrusion amount mm		4.8 – 5.5	–
Timing belt tensioner adjuster rod movement mm		Within 1	–

SEALANTS

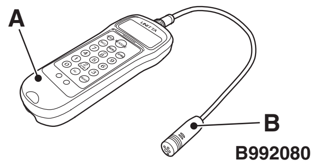
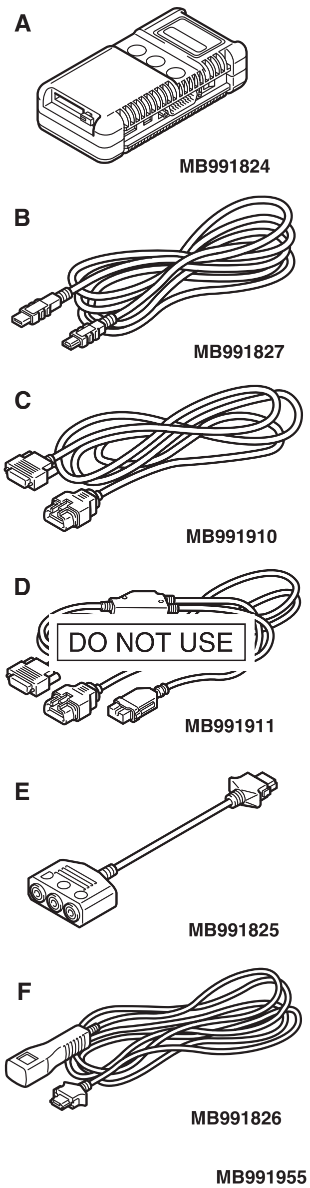
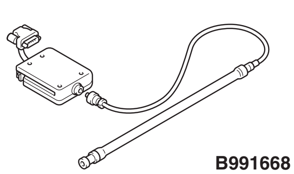
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Item	Specified sealant	Remark
Rocker cover gasket	MITSUBISHI GENUINE PART MD970389 or equivalent	Semi-drying sealant
Cylinder head		
Camshaft position sensor support		
Engine oil pan		

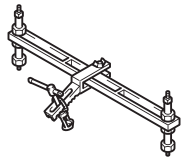
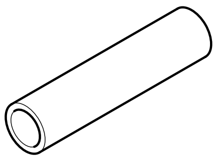
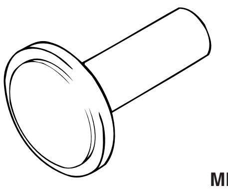
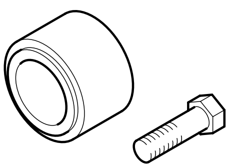
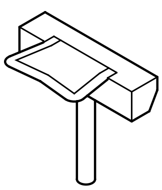
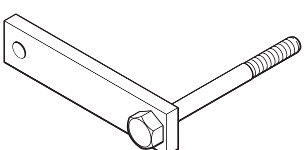
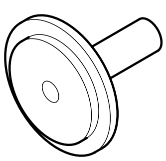
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SPECIAL TOOLS

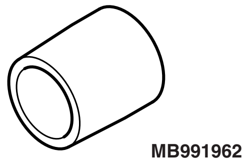
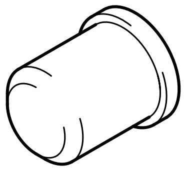
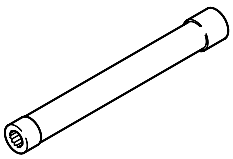
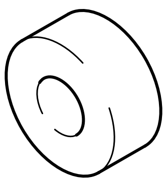
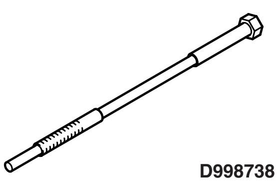
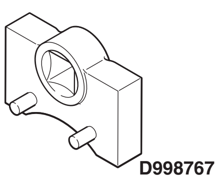
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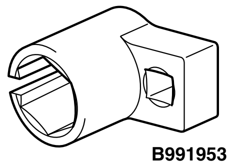
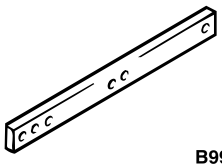
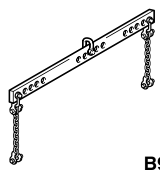
Tool	Number	Name	Use
	MB992080 A: MB992081 B: MB992082	Belt tension meter set A: Belt tension meter B: Microphone assembly	Drive belt tension check
	MB991955 A: MB991824 B: MB991827 C: MB991910 D: MB991911 E: MB991825 F: MB991826	M.U.T.-III sub assembly A: Vehicle communication interface (V. C. I.) B: M.U.T.-III USB cable C: M.U.T.-III main harness A (Vehicles with CAN communication system) D: M.U.T.-III main harness B (Vehicles without CAN communication system) E: M.U.T.-III adapter harness F: M.U.T.-III trigger harness	⚠ CAUTION **For vehicles with CAN communication, use M.U.T.-III main harness A to send simulated vehicle speed. If you connect M.U.T.-III main harness B instead, the CAN communication does not function correctly.** • Drive belt tension check • Checking the ignition timing • Checking the idle speed
	MB991668	Belt tension meter set	Drive belt tension check (used together with M.U.T.-III)

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Tool	Number	Name	Use
 AC204024	MD998772	Valve spring compressor	Compressing intake and exhaust valve spring
	MB991671	Valve stem seal installer	Valve stem seal installation
 MD998762	MD998762	Circular packing installer	For pressing in cylinder head camshaft end seal
	MD998713	Camshaft oil seal installer	Camshaft oil seal
 D998727	MD998727	Oil pan FIPG cutter	Engine oil pan removal
 D998781	MD998781	Flywheel stopper	Supporting the drive plate
	MD998011	Crankshaft rear oil seal installer	Crankshaft rear oil seal installation

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Tool	Number	Name	Use
	MB991962	Crankshaft front oil seal guide	Crankshaft front oil seal installation
	MD998306	Camshaft oil seal installer	
	MB991653	Cylinder head bolt wrench	Removal and installation of cylinder head bolt
	MD998769	Crankshaft sprocket spacer	Removal and installation of valve timing belt
	MD998738	Adjust bolt	Supporting the timing belt tensioner arm and timing belt tensioner adjuster
	MD998767	Tensioner wrench	Valve timing belt tension adjustment

Tool	Number	Name	Use
 B991953	MB991953	Oxygen sensor wrench	Oxygen sensor removal and installation
 B991527	MB991527	Engine hanger	Supporting the engine assembly during removal and installation of the transmission assembly *NOTE: Special tool MB991454 is a part of engine hanger attachment set MB991453.*
 B991454	MB991454	Engine hanger balancer	

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ON-VEHICLE SERVICE

DRIVE BELT TENSION CHECK AND ADJUSTMENT

M1111003101400

ALTERNATOR DRIVE BELT TENSION CHECK

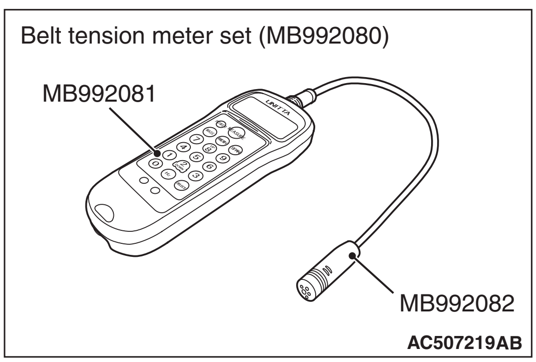
Check the drive belt tension in the following procedure.

Standard value:

Item	When checked	When adjusted	When replaced
Vibration frequency Hz	218 – 266	231 – 255	308 – 344
Tension N	392 – 588	441 – 539	785 – 981
Deflection mm (Reference)	6.3 – 8.0	6.6 – 7.5	4.1 – 5.0

<When the vibration frequency is measured {Special tool (MB992080) is used}: Recommendation>

NOTE: The vibration frequency measuring method is recommended for check and adjustment of the drive belt tension.



1. Connect the Special tool microphone assembly (MB992082) to the Special tool belt tension meter (MB992081) of the Special tool belt tension meter set (MB992080).
2. Press the "POWER" button to turn on the power supply.
3. Press number key 1. Check to ensure that "No. 01" appears on the upper left of the display and that the following numeric values are displayed for individual items (M, W, and S):

   M 000.9 g/m

   W 010.0 mm/R

   S 0100 mm

   If numeric values have not been entered (new tool), set them according to the belt specifications as shown below. Once you set them, you do not have to set them again. The settings remain undeleted even after battery replacement.

   NOTE: This operation is to temporarily set the preset data such as the belt specifications, because if the measurement is taken without input of the belt specifications, conversion to tension value (N) cannot be made, resulting in judgement of error.

   <Setting procedure>

   (1) Press down the "MASS" button till the belt mass select display appears.

   (2) Press the "UP" or "DOWN" button to select "01 1.5GT 0.9" and press the "MEASURE" button to decide it.
   Check to ensure that "M 000.9 g/m" is displayed.

   (3) Press the "WIDTH" button to change to the belt width input display.

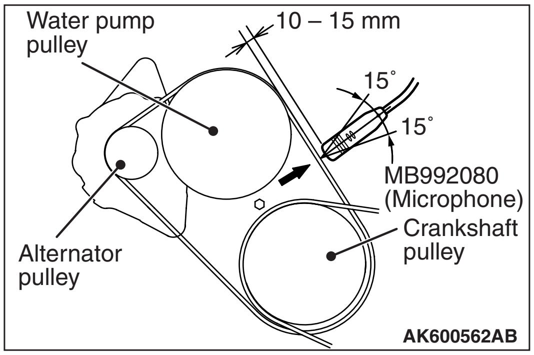
   (4) Press number keys 0, 1, 0, and 0 sequentially, and press the "SELECT" button to apply them. Check to ensure that "W 010.0 mm/R" appears on the display.

   (5) Press the "SPAN" button to change to the span length input display.

   (6) Press number keys 0, 1, 0, and 0 sequentially, and press the "SELECT" button to apply them. Check to ensure that "S 0100 mm" appears on the display.
4. Press "Hz" button twice to change the display to the frequency display (Hz).

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⚠ CAUTION



The temperature of the surface of the belt should be as close as possible to normal temperature.

- **Do not let any contaminants such as water or oil get onto the microphone.**
- **If strong gusts of wind blow against the microphone or if there is loud sources of noise nearby, the values measured by the microphone may not correspond to actual values.**
- **If the microphone is touching the belt while the measurement is being made, the values measured by the microphone may not correspond to actual values.**
- **Do not take the measurement while the vehicle's engine is running.**

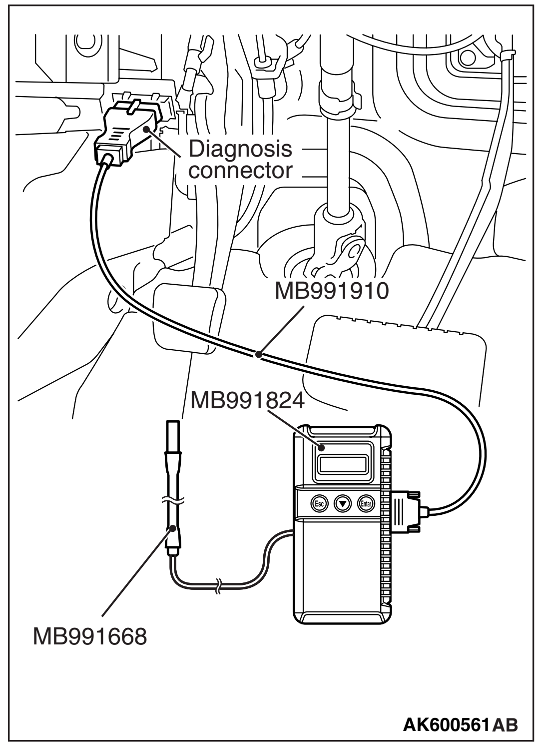
5. Hold the microphone to the middle of the drive belt between the pulleys (at the place indicated by the arrow), about 10 – 15 mm away from the rear surface of the belt and so that it is perpendicular to the belt (within an angle of ± 15 °).
6. Press the "MEASURE" button.
7. Gently tap the middle of the belt between the pulleys (the place indicated by the arrow) with your finger as shown in the illustration, and check that the vibration frequency of the belt is within the standard value.

   NOTE: To take the measurement repeatedly, fillip the belt again.
8. After the completion of the measurement, press and hold the "POWER" button to turn off the power supply.

<When the vibration frequency is measured vehicle communication interface (V.C.I.) is used: Recommendation>

NOTE: The vibration frequency measuring method is recommended for check and adjustment of the drive belt tension.

⚠ CAUTION



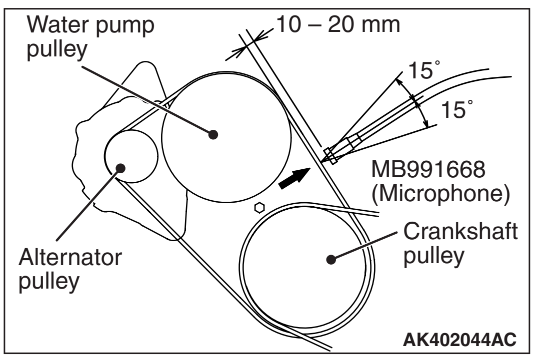
To prevent damage to special tool V.C.I. (MB991824), always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting special tool V.C.I. (MB991824).

1. Connect the special tool belt tension meter set (MB991668) to the special tool V.C.I (MB991824).
2. Connect special tool M.U.T.-III main harness A (MB991910) to special tool V.C.I. (MB991824).
3. Connect special tool M.U.T.-III main harness A (MB991910) to the diagnosis connector.
4. Turn the ignition switch to the "ON" position and select "Belt Tension Measurement" from the menu screen.

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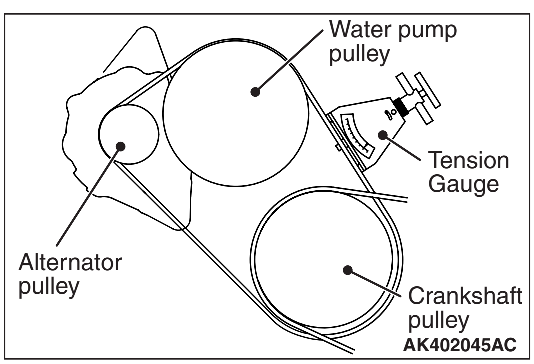
⚠ **CAUTION**

- **The temperature of the surface of the belt should be as close as possible to normal temperature.**
- **Do not let any contaminants such as water or oil get onto the microphone.**
- **If strong gusts of wind blow against the microphone or if there is loud sources of noise nearby, the values measured by the microphone may not correspond to actual values.**
- **If the microphone is touching the belt while the measurement is being made, the values measured by the microphone may not correspond to actual values.**
- **Do not take the measurement while the vehicle's engine is running.**



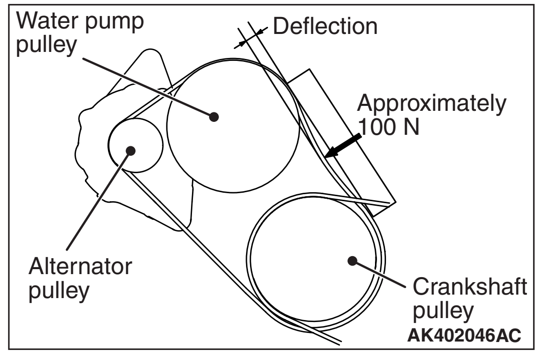
5. Hold the microphone to the middle of the drive belt between the pulleys (at the place indicated by the arrow), about 10 – 20 mm away from the rear surface of the belt and so that it is perpendicular to the belt (within an angle of ± 15 °).
6. Gently tap the middle of the belt between the pulleys (the place indicated by the arrow) with your finger as shown in the illustration, and check that the vibration frequency of the belt is within the standard value.

<When using the tension gauge>

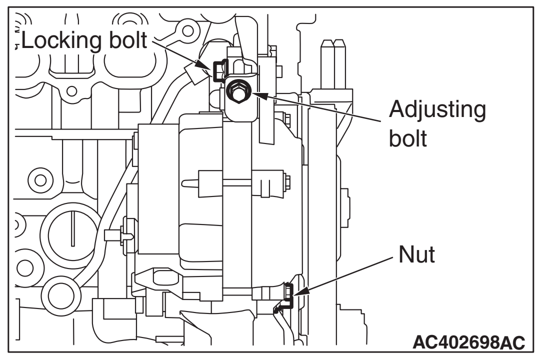


Use a belt tension gauge to check that the belt tension is within the standard value.

<Belt deflection check>



Apply approx. 100 N of force to the middle of the drive belt between the pulleys (at the place indicated by the arrow) and check that the amount of deflection is within the standard value.



If not within the standard value, adjust the belt tension by the following procedure.

1. Loosen the nut of the alternator pivot bolt.
2. Loosen the lock bolt.
3. Use the adjusting bolt to adjust the belt tension and belt deflection to the standard values.
4. Tighten the nut of the alternator pivot bolt.

   Tightening torque: 44 ± 10 N·m
5. Tighten the nut of the lock bolt.

   Tightening torque: 23 ± 2 N·m
6. Tighten the adjusting bolt.

   Tightening torque: 5.0 ± 1.0 N·m

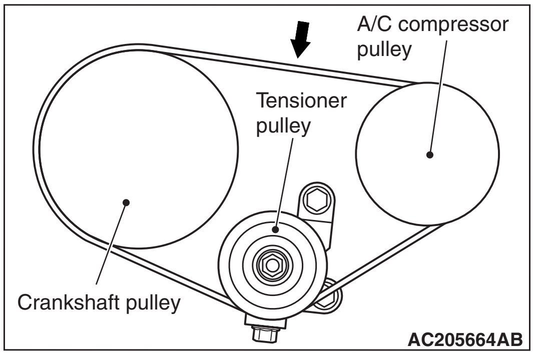
⚠ **CAUTION**

When checking the belt tension, turn the crankshaft clockwise one turn or more.

7. Check the belt tension, and readjust if necessary.
8. When the belt tension is adjusted by measuring the deflection, adjust it with a tool for vibration frequency measurement or tension measurement afterward.

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A/C COMPRESSOR DRIVE BELT TENSION CHECK AND ADJUSTMENT



Check the drive belt tension by the following procedures.

Standard value:

Item	When checked	When adjusted	When replaced
Vibration frequency Hz	165 – 213	179 – 203	213 – 253
Tension N	294 – 490	343 – 441	490 – 686
Deflection mm (Reference)	8.9 – 11.2	9.3 – 10.7	6.6 – 8.6

<When the vibration frequency is measured: Recommendation>

Gently tap the centre of the belt between the pulleys (arrow), and check that the belt vibration frequency is within the standard value.

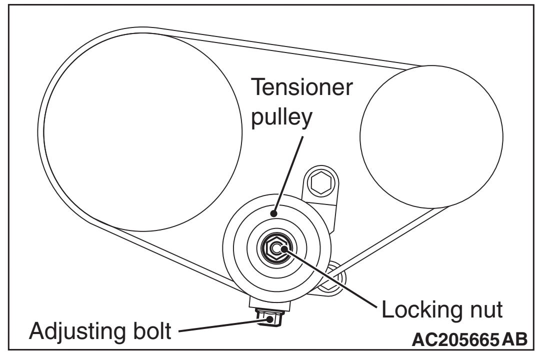
<When tension is measured>

Place a belt tension gauge at the centre of the belt between the pulleys (arrow), and check that the belt tension is within the standard value.

<When deflection is measured>

Apply approx. 100 N of pressure against the location between the pulleys shown by the arrow in the illustration and then measure the deflection.

If not within the standard value, adjust the belt tension by the following procedure.



1. Loosen the locking nut of the tensioner pulley.
2. Use the adjusting bolt to adjust the belt tension. The tension will increase when turning the adjusting bolt clockwise, and decrease when turning anti-clockwise.
3. Tighten the locking nut of the tensioner pulley at the specified torque.

   Tightening torque: 48 ± 6 N·m
4. Tighten the adjusting bolt at the specified torque.

   Tightening torque: 5.0 ± 1.0 N·m

⚠ CAUTION

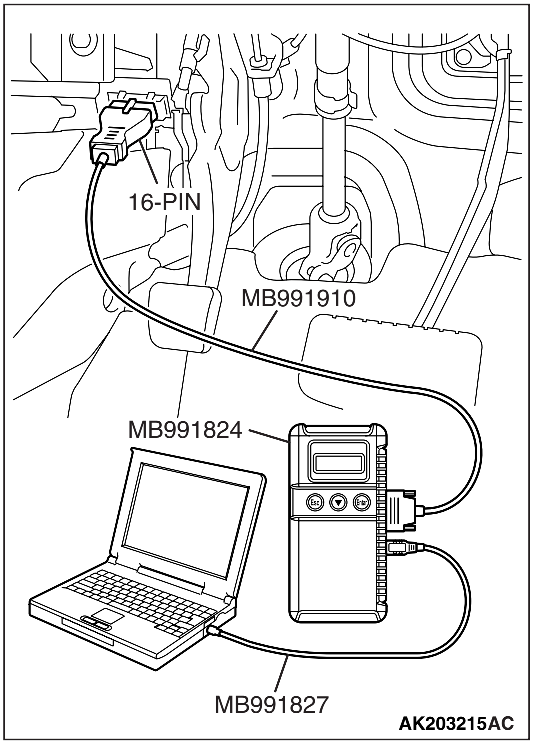
When checking the belt tension, turn the crankshaft clockwise one turn or more.

5. Check the belt tension, and readjust if necessary.
6. When the belt tension is adjusted by measuring the deflection, adjust it with a tool for vibration frequency measurement or tension measurement afterward.

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IGNITION TIMING CHECK

M1111001701235



1. Before inspection, set the vehicle to the pre-inspection condition.
2. Turn the ignition switch to the "LOCK" (OFF) position and then connect the M.U.T.-III to the diagnosis connector.
3. Set the timing light to the power supply line (terminal No.1) of the ignition coil No.1.
4. Start the engine and let it run at idle.
5. Use the M.U.T.-III to measure engine idle speed and check that it is approximately 750 r/min.
6. Select No. 17 of the M.U.T.-III Actuator test.
7. Check that basic ignition timing is within the standard value.

   Standard value: 5° BTDC ± 3°

8. If the basic ignition timing is outside the standard value, inspect the MPI system (Refer to GROUP 13B – Troubleshooting – Inspection chart for diagnosis code P.13B-18).

⚠ CAUTION

If the test is not cancelled, a forced driving will continue for 27 minutes. Driving under this condition may damage the engine.

9. Press the M.U.T.-III clear key (Select a forced driving cancel mode) to release the Actuator test.
10. Check that ignition timing is at the standard value.

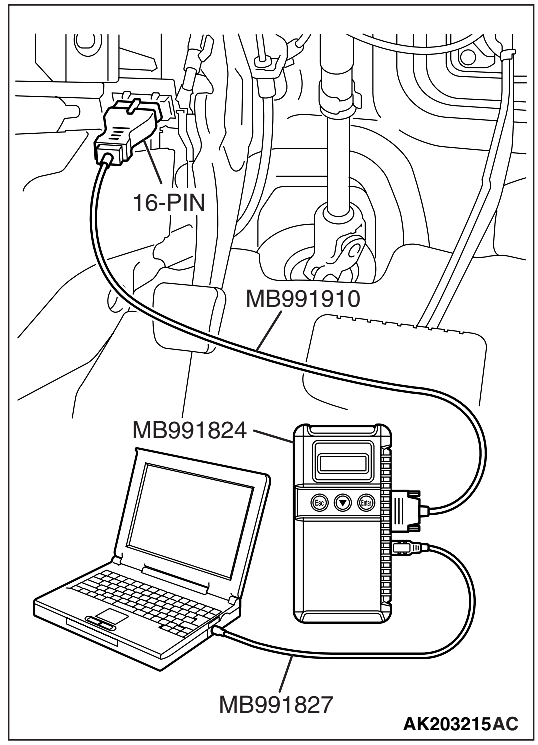
    Standard value: approximately 10° BTDC

    NOTE:
    - *The ignition timing may fluctuate within ± 7° BTDC. This is normal.*
    - *In higher altitude, the ignition timing is more advanced than the standard value by approximately 5°.*

11. Remove the timing light.
12. Turn off the ignition switch and then remove the M.U.T.-III.

IDLE SPEED CHECK

M1111003501130



1. Before inspection, set the vehicle to the pre-inspection condition.
2. Turn the ignition switch to "LOCK" (OFF) position.
3. Connect the M.U.T.-III to the diagnosis connector.
4. Set the timing light to the power supply line (terminal No.1) of the ignition coil No.1.
5. Start the engine and let it run at idle.
6. Check that ignition timing is at the standard value.

   Standard value: approximately 10° BTDC

7. Check the idle speed.

   Standard value: 750 ± 50 r/min

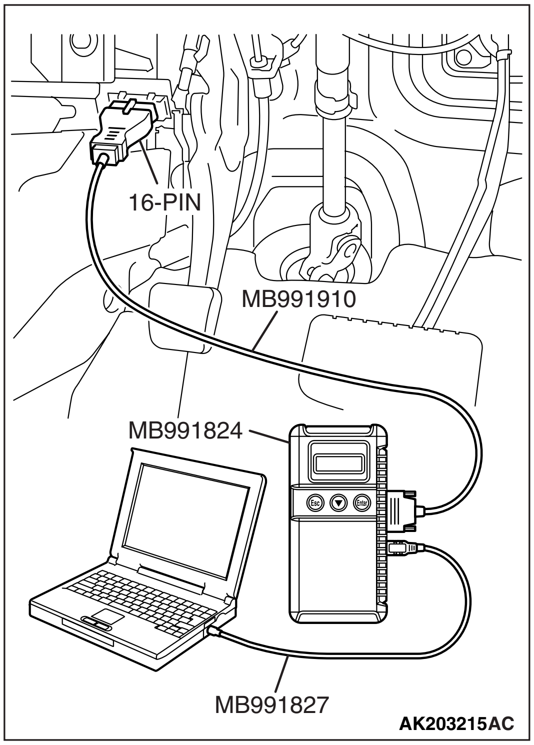
   NOTE:
   - *The idle speed is controlled automatically by the idle speed control system.*
   - *When using the M.U.T.-III, select item No. 22 and take a reading of the idle speed.*

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8. If the idle speed is outside the standard value, inspect the MPI system (Refer to GROUP 13B – Troubleshooting – Inspection chart for diagnosis code P.13B-18).

IDLE MIXTURE CHECK

M1111002100868



1. Before inspection, set the vehicle to the pre-inspection condition.
2. Turn the ignition switch to "LOCK" (OFF) position.
3. Connect the M.U.T.-III to the diagnosis connector.
4. Set the timing light to the power supply line (terminal No.1) of the ignition coil No.1.
5. Start the engine and let it run at idle.
6. Check that ignition timing is at the standard value.

   Standard value: approximately 10° BTDC

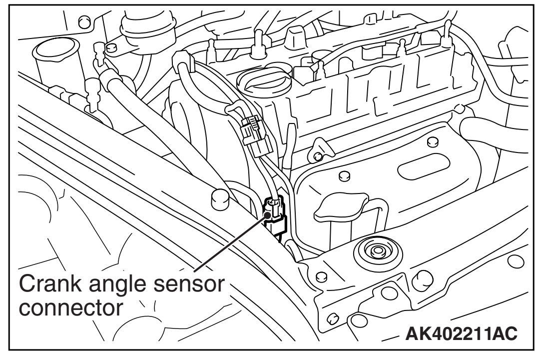
7. Run the engine at 2,500 r/min for 2 minutes.
8. Set the CO, HC tester.
9. Check the CO contents and the HC contents at idle.

   Standard value
   CO contents: 0.5% or less
   HC contents: 100 ppm or less

10. If there is a deviation from the standard value, inspect the MPI system (Refer to GROUP 13B – Troubleshooting – Inspection chart diagnosis code P.13B-18)

COMPRESSION PRESSURE CHECK

M1111002601297

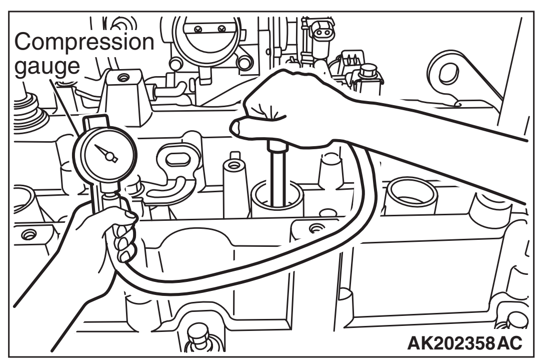


1. Before inspection, set the vehicle to the pre-inspection condition.
2. Remove all of the ignition coil and spark plugs.
3. Disconnect the crank angle sensor connector.

   NOTE: Doing this will prevent the engine-CVT-ECU from carrying out ignition and fuel injection.

⚠ CAUTION
- **Keep away from the spark plug hole when cranking.**
- **If compression is measured with water, oil, fuel, etc., that has come from cracks inside the cylinder, these materials will become heated and will gush out from the spark plug hole, which is dangerous.**

4. Cover the spark plug hole with a shop towel etc., and after the engine has been cranked, check that no foreign material is adhering to the shop towel.



5. Set compression gauge to one of the spark plug holes.
6. Crank the engine with the throttle valve fully open and measure the compression pressure.

   Standard value (at engine speed of 300 r/min):
   1,210 kPa

   Limit (at engine speed of 300 r/min):
   Minimum 830 kPa

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7. Measure the compression pressure for all the cylinders, and check that the pressure differences of the cylinders are below the limit.

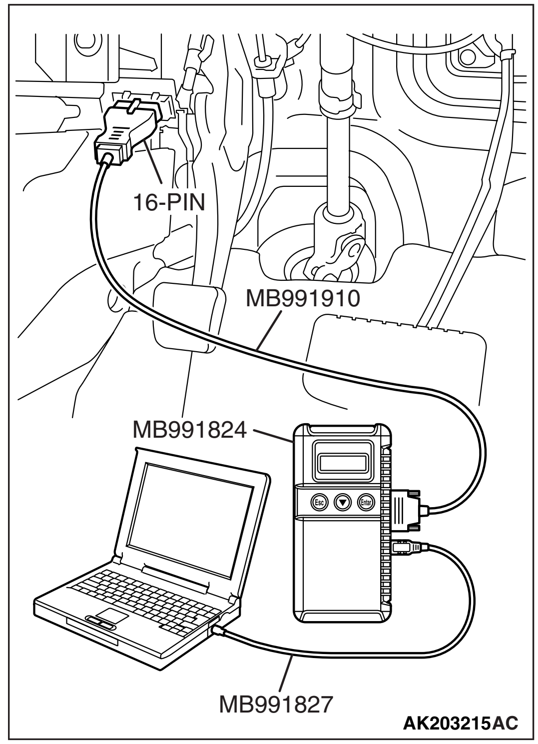
   Limit: Maximum 98 kPa

8. If there is a cylinder with compression or a compression difference that is outside the limit, pour a small amount of engine oil through the spark plug hole, and repeat the operations in steps from (5) to (7).
   (1) If the compression increases after oil is added, the cause of the malfunction is a worn or damaged piston ring and/or cylinder inner surface.
   (2) If the compression dose not rise after oil is added, the cause is a burnt or defective valve seat, or pressure is leaking from the gasket.
9. Connect the crank angle sensor connector.
10. Install the spark plugs and ignition coils.
11. Use the M.U.T.-III to erase the diagnosis codes.

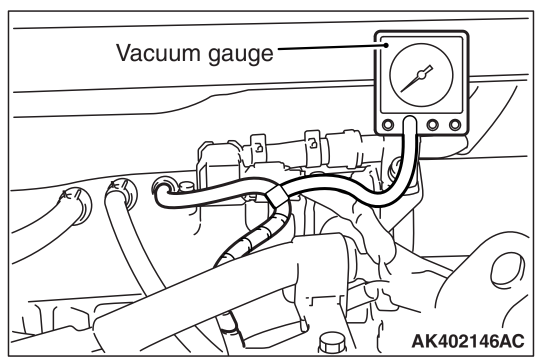
   NOTE: This will erase the diagnosis code resulting from the crank angle sensor connector being disconnected.

MANIFOLD VACUUM CHECK

M1111002700967



1. Before inspection, set the vehicle to the pre-inspection condition.
2. Turn the ignition switch to "LOCK" (OFF) position.
3. Connect a tachometer or connect the M.U.T.-III to the diagnosis connector.



4. Attach a three-way joint to the vacuum hose between the fuel pressure solenoid valve and the inlet manifold, and connect a vacuum gauge.
5. Start the engine and check that idle speed is approximately 750 r/min.
6. Check the inlet manifold vacuum.

   Limit: Minimum 60 kPa

7. Turn off the ignition switch.
8. Remove the vacuum gauge and the three-way joint, and then connect the vacuum hose.
9. Remove the engine tachometer or the M.U.T.-III.

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LASH ADJUSTER CHECK

M1111002900637

If an abnormal noise (knocking) that seems to be coming from the lash adjuster is heard after starting the engine and dose not stop, carry out the following check.

NOTE:

- *If the vehicle is parked on a slope fir a long period of time, the amount of oil inside the lash adjuster will decrease, and air may get into the high pressure chamber when starting the engine.*
- *After parking the vehicle for long periods, the oil drains out of the oil passage, and it takes time for the oil to be supplied to the lash adjuster, so air can get into the high-pressure chamber.*
- *If either of the above situations occur, the abnormal noise can be eliminated by bleeding the air from inside the lash adjusters.*
- *The abnormal noise which is caused by a problem with the lash adjusters is generated after the engine is started, and will vary according to the engine speed. However, this noise is not related to the actual engine load.*

Because of this, if the noise dose not occur immediately after the engine is started, if it dose not change in accordance with the engine speed, or if it changes in accordance with the engine load, the source of the noise is not the lash adjusters.

- *If there is a problem with the lash adjusters, the noise will almost never disappear, even if the engine has been run at idle to let it warm up.*

The only case where the noise might disappear is if the oil in the engine has not been looked after properly and oil sludge has caused the lash adjusters to stick.

<FUNCTIONAL INSPECTION>

1. Start the engine.
2. Check that the noise occurs immediately after the engine is started, and that the noise changes in accordance with changes in the engine speed.

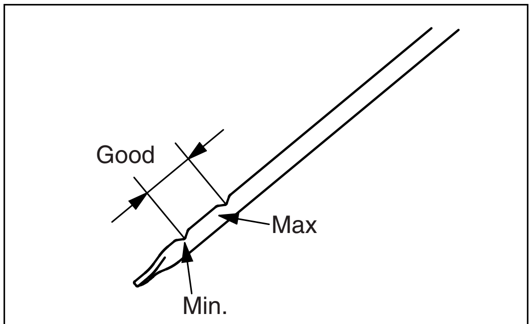
   If the noise dose not occur immediately after the engine is started, or if it dose not change in accordance with the engine speed, the problem is not being caused by the lash adjusters, so check for some other cause of the problem. Moreover, if the noise dose not change in accordance with the engine speed, the cause of the problem is probably not with the engine (In these cases, the lash adjusters are normal).
3. While the engine is idling, check that the noise level does not change when the engine load is varied (for example, by shifting from N to D).

   If the noise level changes, the cause of the noise is probably parts striking because of worn crankshaft bearings or connecting rod bearings (In such cases, the lash adjusters are normal).
4. After the engine has warmed up, run it at idle and check if any noise can be heard.

   If the noise has become smaller or disappeared, oil sludge could make the lash adjusters stick. Clean the lash adjusters (Refer to GROUP 11D − Rocker Arms and Camshaft − Rocker Arms and Camshaft Inspection P.11D-30). If not improved, go to step 5.
5. Bleed air from the lash adjusters (Refer to P.11C-16).
6. If the noise has not disappeared even after the air bleeding, clean the lash adjusters (Refer to GROUP 11D − Rocker Arms and Camshaft − Rocker Arms and Camshaft Inspection P.11D-30).

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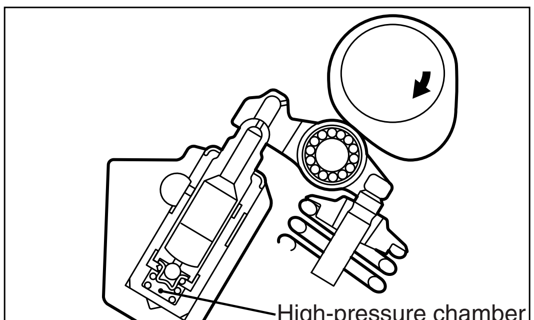
<LASH ADJUSTER AIR BLEEDING>



AKX00328AE

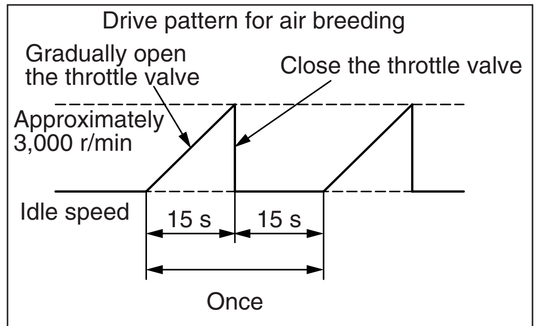
1. Check the engine oil and replenish or replace the oil if necessary.

   NOTE:
   - *If there is an only small amount of oil, air will be drawn in through the oil screen and will get into the oil passage.*
   - *If the amount of oil is greater than normal, then the oil will being mixed by the crankshaft and a large amount of air may get mixed into the oil.*
   - *If the oil is degenerated, air and oil will not separate easily in oil, and the amount of air mixed into the oil will increase.*



AK100001AC

   - *If the air which has been mixed in with the oil due to any of the above reasons gets into the high pressure chamber of the lash adjuster, the air inside the high pressure chamber will be compressed when the valve is open and the lash adjuster will over-compress, resulting in abnormal noise when the valve close. This is the same effect as if the valve clearance is adjusted to be too large by mistake. If the air inside the lash adjusters is then released, the operation of the lash adjusters will return to normal.*



AKX00330AE

2. Run the engine at idle for 1 – 3 minutes to let it warm up.
3. With no load on the engine, repeat the drive pattern shown in the illustration above and check if the abnormal noise disappears (The noise should normally disappear after 10 – 30 repetitions, but if there is no change in the noise level after 30 repetitions or more, the problem is probably not due to air inside the lash adjusters).
4. After the noise has disappeared, repeat the drive pattern shown in the illustration above a further 5 times.
5. Run the engine at idle for 1 – 3 minutes and check that the noise has disappeared.

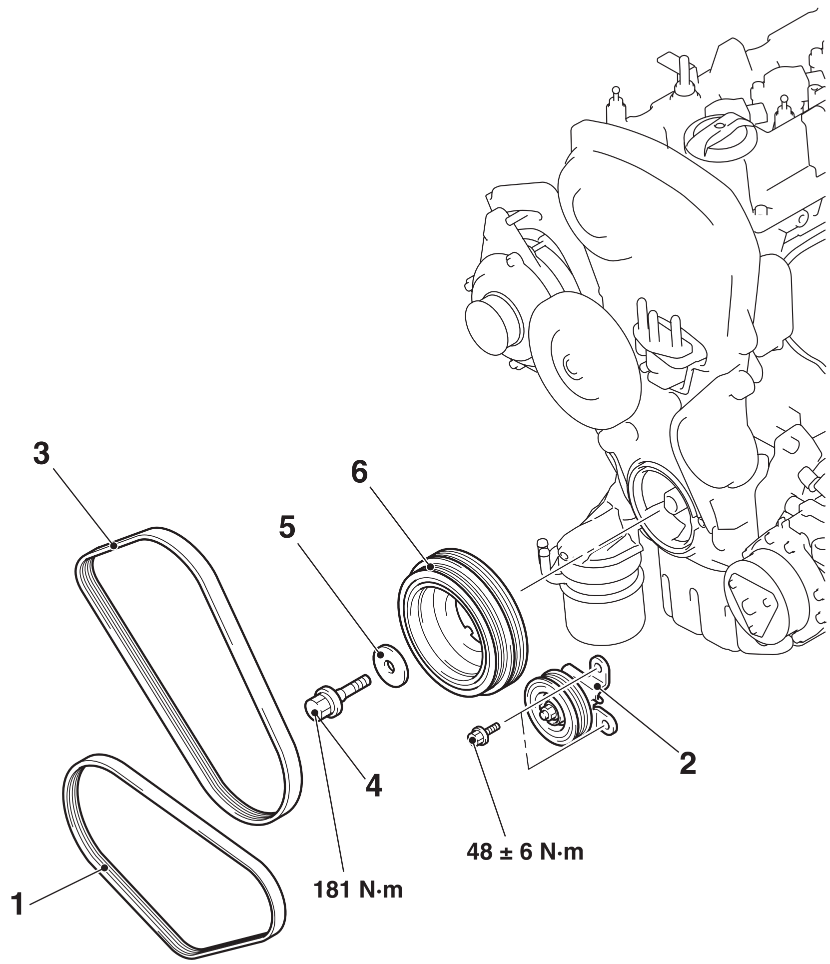
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CRANKSHAFT PULLEY

REMOVAL AND INSTALLATION

M1112001601242

Pre-removal Operation	Post-installation Operation
• Front Under Cover Panel Removal (Refer to GROUP 51, Front Bumper Assembly and Radiator Grille P.51-2). • Side Under Cover Panel (RH) Removal (Refer to GROUP 51, Front Bumper Assembly and Radiator Grille P.51-2).	• Drive Belt Tension Check and Adjustment (Refer to P.11C-8). • Side Under Cover Panel (RH) Installation (Refer to GROUP 51, Front Bumper Assembly and Radiator Grille P.51-2). • Front Under Cover Panel Installation (Refer to GROUP 51, Front Bumper Assembly and Radiator Grille P.51-2).



Removal steps

<<**A**>>		1.	A/C compressor drive belt
		2.	A/C compressor drive belt tensioner assembly
<<**B**>>		3.	Alternator drive belt
<<**C**>>	>>**A**<<	4.	Crankshaft pulley centre bolt

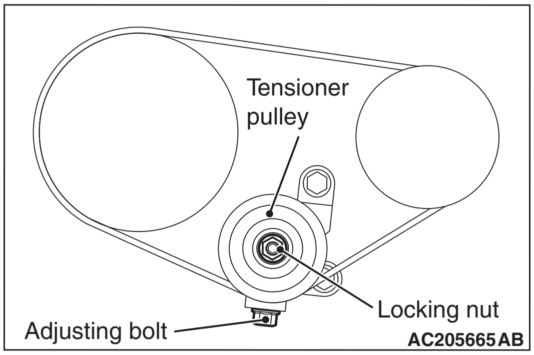
Removal steps (Continued)

>>**A**<<	5.	Crankshaft pulley washer
>>**A**<<	6.	Crankshaft pulley

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REMOVAL SERVICE POINTS

<<A>> A/C COMPRESSOR DRIVE BELT REMOVAL



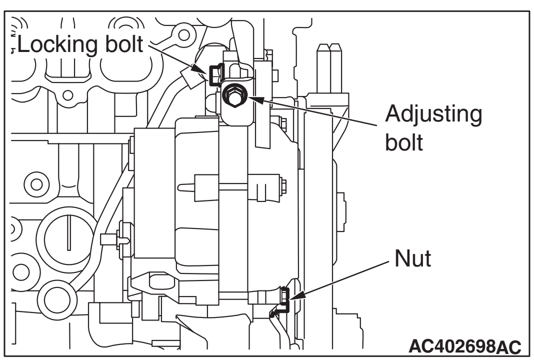
1. Loosen the locking nut of the tensioner pulley

⚠ CAUTION

To reuse the drive belt, draw an arrow indicating the rotating direction (clockwise) on the back of the belt using chalk, etc.

2. Turn the adjusting bolt in the anti-clockwise direction (to the left) to remove the drive belt.

<<B>> ALTERNATOR DRIVE BELT REMOVAL



1. Loosen the nut for alternator pivot bolt and locking bolt.

⚠ CAUTION

To reuse the drive belt, draw an arrow indicating the rotating direction (clockwise) on the back of the belt using chalk, etc.

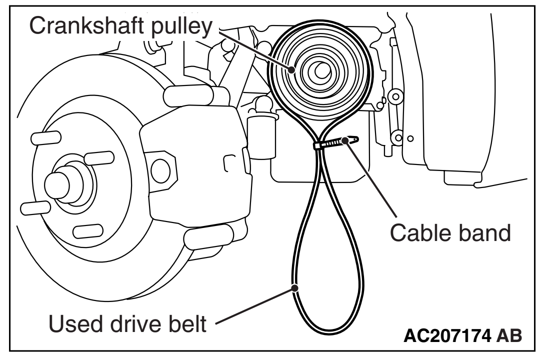
2. Turn the adjusting bolt in the anti-clockwise direction (to the left) to remove the drive belt.

<<C>> CRANKSHAFT PULLEY CENTRE BOLT REMOVAL

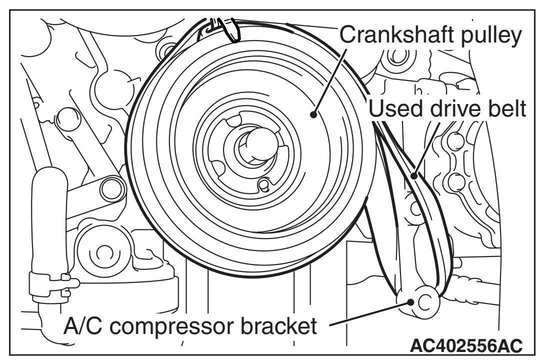
Use the used drive belt to fix the crankshaft pulley and loosen the crankshaft pulley bolt.

⚠ CAUTION

- **Do not use the drive belt set up on the vehicles.**
- **Do not use a cracked or damaged drive belt.**



1. Set the used drive belt as shown and hold it with a cable band.

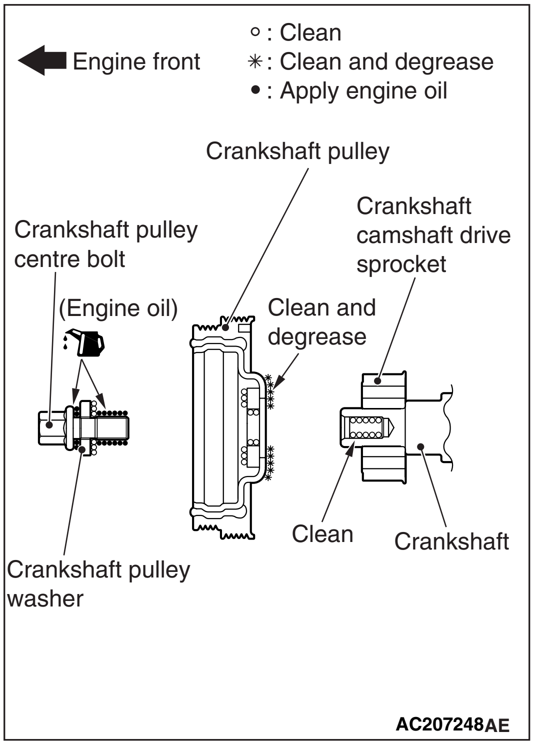


2. Turning the crankshaft pulley to the anti-clockwise direction (to the left), place the used drive belt to the A/C compressor bracket, hold the crankshaft pulley and remove the crankshaft pulley bolt.

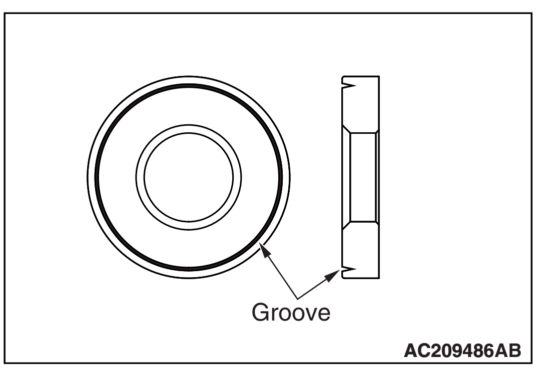
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INSTALLATION SERVICE POINT

>>A<< CRANKSHAFT PULLEY/CRANKSHAFT PULLEY WASHER/CRANKSHAFT PULLEY CENTRE BOLT INSTALLATION

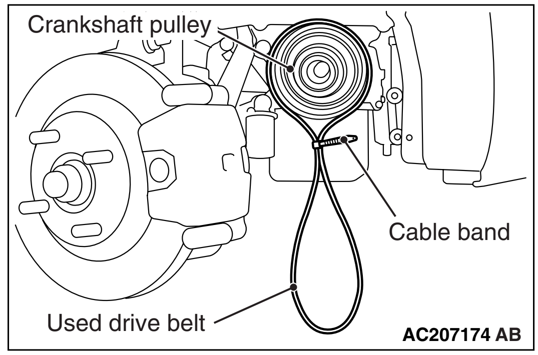


1. Clean the screw hole of the crank shaft, the crankshaft pulley, the crankshaft pulley washer and the crankshaft pulley bolt.
2. Clean and degrease the crankshaft pulley installation side and install the crankshaft pulley.
3. Apply an appropriate quantity of new engine oil to the thread of crankshaft pulley bolt and the crankshaft pulley washer top face.

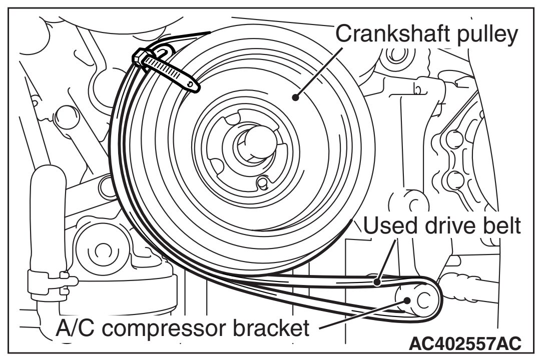


4. Place the crankshaft pulley washer with the groove facing on the bolt side.

⚠ CAUTION
- **Do not use the drive belt setup on the vehicles.**
- **Do not use a cracked or damaged drive belt.**



5. Set the used drive belt and hold it with a cable band as during removal.



6. Turning the crankshaft pulley assembly to the clockwise direction (to the right), place the used drive belt to the A/C compressor bracket, hold the crankshaft pulley assembly and tighten the crankshaft pulley bolt to the specified torque.

Tightening torque:181 N·m

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CAMSHAFT AND VALVE STEM SEAL

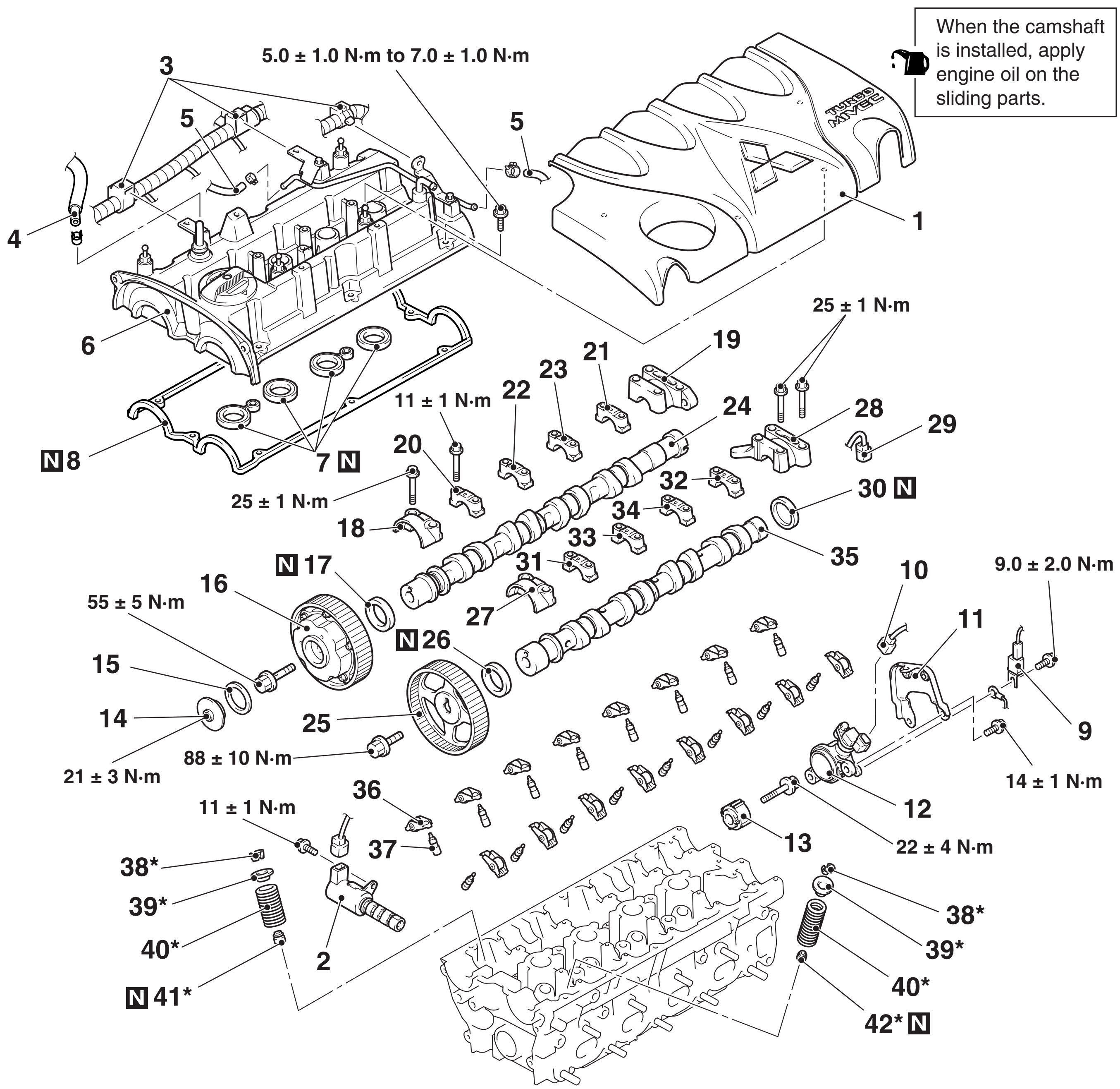
REMOVAL AND INSTALLATION

M1112006601269

⚠ CAUTION

*** Remove and assemble the marked parts in each cylinder unit.**

Pre-removal Operation	Post-installation Operation
• Air Cleaner Intake Duct, Air Cleaner Assembly and Air Cleaner Duct Removal (Refer to GROUP 15, Air Cleaner P.15-6). • Valve Timing Belt Removal (Refer to P.11C-37).	• Valve Timing Belt Installation (Refer to P.11C-37). • Air Cleaner Intake Duct, Air Cleaner Assembly and Air Cleaner Duct Installation (Refer to GROUP 15, Air Cleaner P.15-6). • Drive Belt Tension Check and Adjustment (Refer to P.11C-8).



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Removal steps

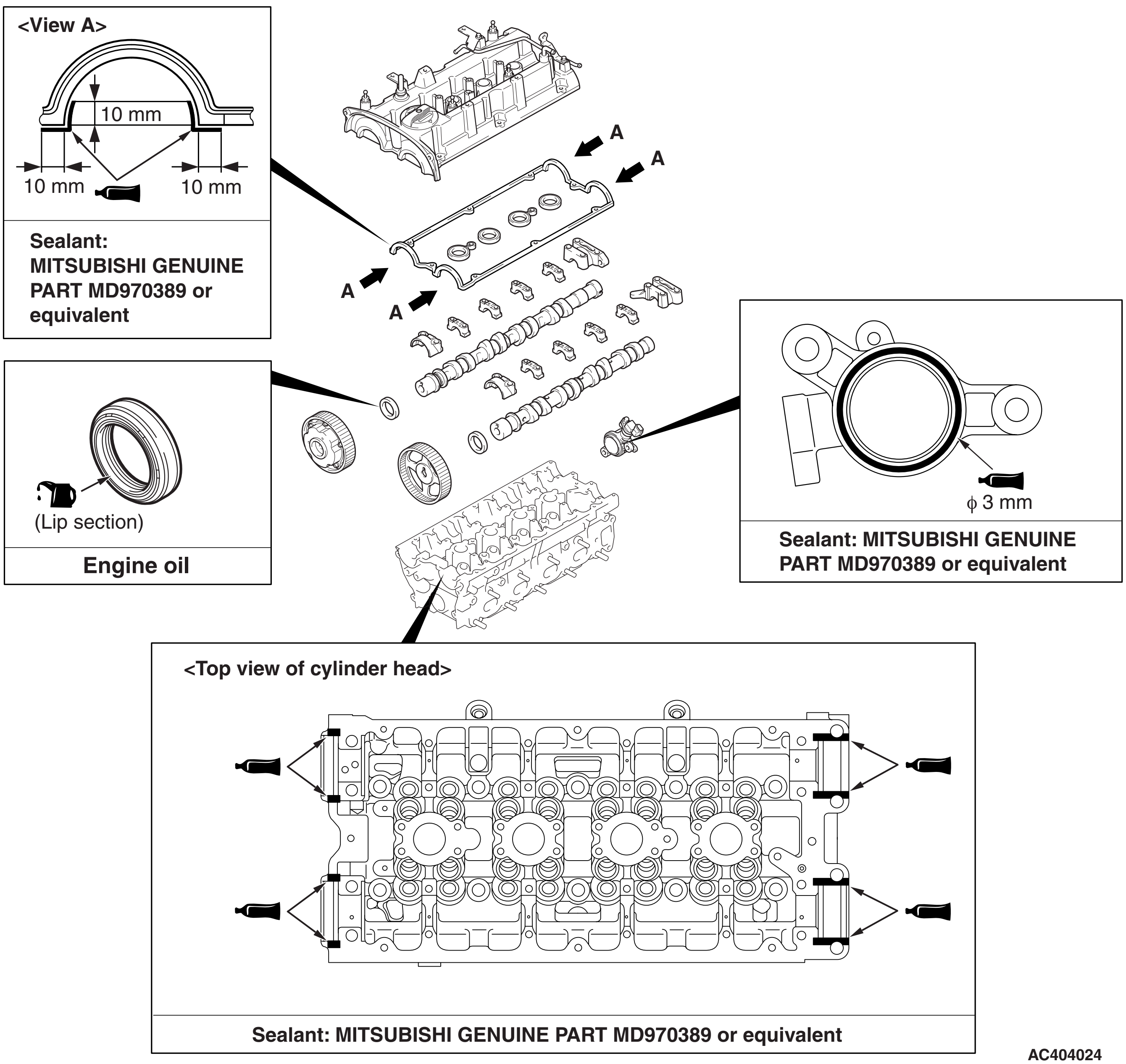
		1.	Engine cover
	>>**N**<<	2.	Oil control valve
		•	Ignition coil (Refer to GROUP 16, Ignition System – Ignition Coil P.16-37).
		3.	Control wiring harness clamp
		4.	Rocker cover PCV hose connection
		5.	Vacuum hose connection
	>>M<<	6.	Rocker cover assembly
		7.	Spark plug hole gasket
		8.	Rocker cover gasket
		9.	Noise condenser
		10.	Camshaft position sensor connector
		11.	Air intake pipe bracket
	>>**L**<<	12.	Camshaft position sensor support
	>>**K**<<	13.	Camshaft position sensing cylinder
<<**A**>>		14.	Camshaft sprocket cap
		15.	Washer
<<**B**>>	>>**J**<<	16.	Camshaft sprocket (inlet side)
	>>**H**<<	17.	Camshaft oil seal
	>>**F**<<	18.	Camshaft bearing cap, front
	>>**F**<<	19.	Camshaft bearing cap, rear right

Removal steps (Continued)

	>>**F**<<	20.	Camshaft bearing cap, No.2
	>>**F**<<	21.	Camshaft bearing cap, No.5
	>>**F**<<	22.	Camshaft bearing cap, No.3
	>>**F**<<	23.	Camshaft bearing cap, No.4
	>>**E**<<	24.	Inlet camshaft
<<**B**>>	>>**I**<<	25.	Camshaft sprocket (exhaust side)
	>>**H**<<	26.	Camshaft oil seal
	>>**F**<<	27.	Camshaft bearing cap, front
	>>**F**<<	28.	Camshaft bearing cap, rear left
		29.	Waste gate solenoid valve connector
	>>**G**<<	30.	Cylinder head camshaft end seal
	>>**F**<<	31.	Camshaft bearing cap, No.2
	>>**F**<<	32.	Camshaft bearing cap, No.5
	>>**F**<<	33.	Camshaft bearing cap, No.3
	>>**F**<<	34.	Camshaft bearing cap, No.4
	>>**E**<<	35.	Exhaust camshaft
		36.	Rocker arm
	>>**D**<<	37.	Rocker arm lash adjuster
<<**C**>>	>>**C**<<	38.	Valve spring retainer lock
		39.	Valve spring retainer
	>>**B**<<	40.	Valve spring
	>>**A**<<	41.	Inlet valve stem seal
	>>**A**<<	42.	Exhaust valve stem seal

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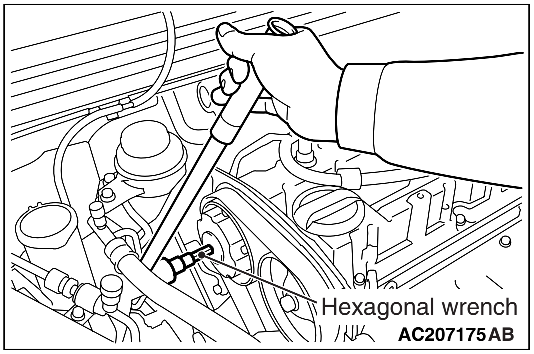
LUBRICATION AND SEALING POINTS



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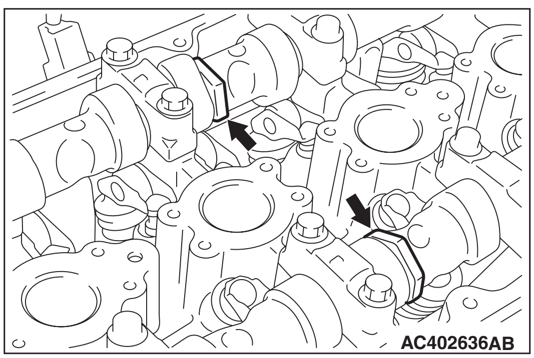
REMOVAL SERVICE POINTS

<<A>> CAMSHAFT SPROCKET CAP REMOVAL



Remove the camshaft sprocket cap with a 8-mm hexagonal wrench.

<<B>> CAMSHAFT SPROCKET REMOVAL

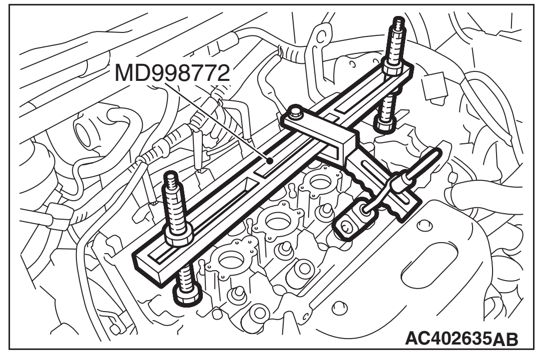


1. Hold the hexagon part of the camshaft with a wrench.
2. Loosen the camshaft sprocket mounting bolt and remove the camshaft sprocket.

<<C>> VALVE SPRING RETAINER LOCK REMOVAL

⚠ CAUTION

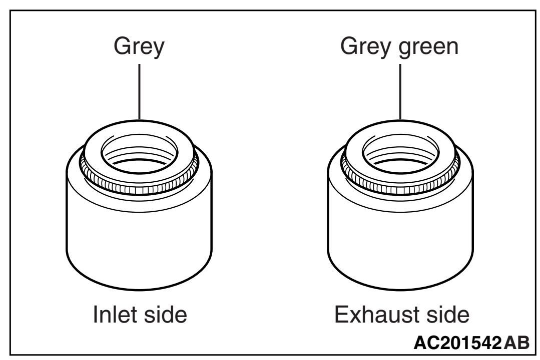
When removing valve spring retainer locks, leave the piston of each cylinder in the TDC (Top Dead Centre) position. The valve may fall into the cylinder if the piston is not properly in the TDC position.



Use special tool valve spring compressor (MD998772) to compress the valve spring and then remove the valve spring retainer lock.

INSTALLATION SERVICE POINTS

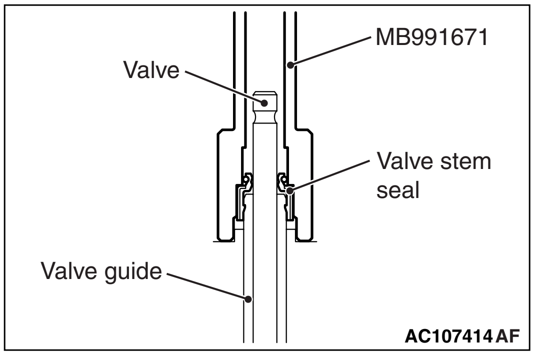
>>A<< EXHAUST VALVE STEM SEAL/INLET VALVE STEM SEAL INSTALLATION



1. Check the valve stem seal colour to identify the inlet side or exhaust side.
2. Apply a small amount of engine oil to the valve stem seal.

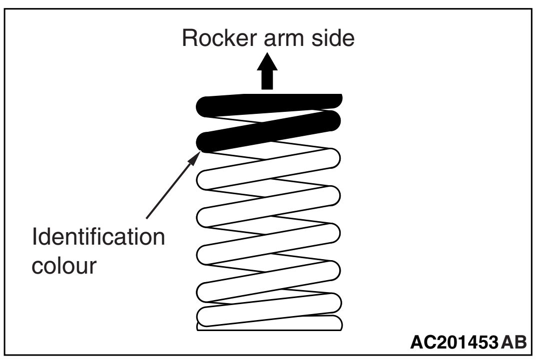
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⚠ CAUTION
- **Do not re-use the valve stem seal.**
- **Special tool valve stem seal installer (MB991671) must be used to install the valve stem seal. Improper installation could result in oil leaking past the valve guide.**



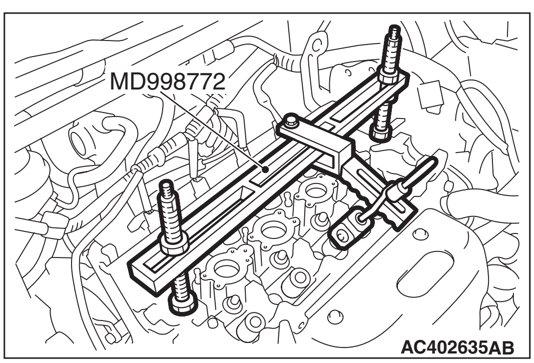
3. Use special tool valve stem seal installer (MB991671) to fill a new valve stem seal in the valve guide using the valve stem area as a guide.

>>B<< VALVE SPRING INSTALLATION



Install the valve spring with its identification colour painted end facing the locker arm.

>>C<< VALVE SPRING RETAINER LOCK INSTALLATION



Use special tool valve spring compressor (MD998772) to compress the valve spring in the same manner as removal.

>>D<< ROCKER ARM LASH ADJUSTER INSTALLATION

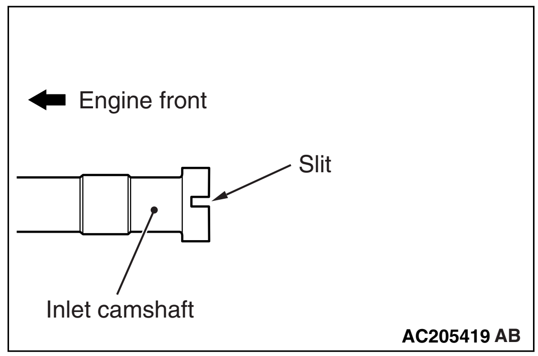
⚠ CAUTION

If the rocker arm lash adjuster is reused, always clean and check it before installation.(Refer to GROUP 11D, Rocker Arms and Camshaft P.11D-30).

>>E<< EXHAUST CAMSHAFT/INLET CAMSHAFT INSTALLATION

1. Remove sealant remained on the engine cylinder head.
2. Apply engine oil to the cam and the journal of the camshaft.

⚠ CAUTION

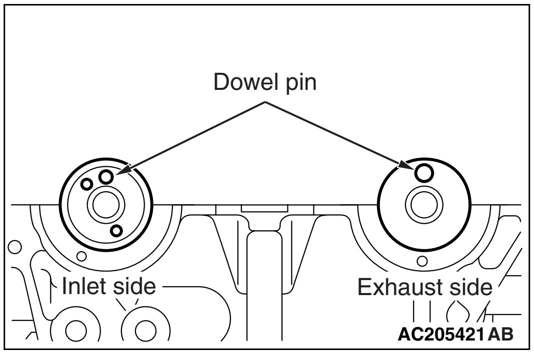


Do not install wrong camshaft at the side of inlet or exhaust. The inlet camshaft has a slit at the rear surface.

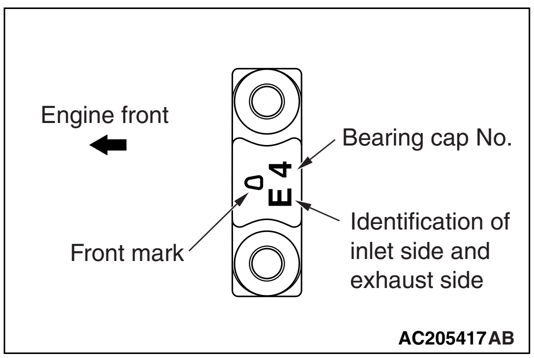
3. Install the camshaft to the engine cylinder head.

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>>F<< CAMSHAFT BEARING CAP, NO. 4/CAMSHAFT BEARING CAP, NO. 3/CAMSHAFT BEARING CAP, NO. 5/CAMSHAFT BEARING CAP, NO. 2/CAMSHAFT BEARING CAP, REAR LEFT/CAMSHAFT BEARING CAP, FRONT/CAMSHAFT BEARING CAP, REAR RIGHT INSTALLATION

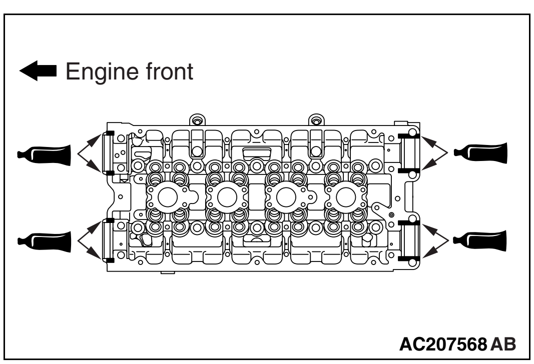


1. Set the dowel pin of the camshaft to the position as shown in the illustration.



2. Camshaft bearing caps (No.2 to 5) are identical. To avoid confusion (bearing cap No. and inlet/exhaust side), confirm each identification mark and face the front mark towards the direction shown before installing them.

   Identification mark (engraved on the front and bearing caps No.2 – 5)
   I: Inlet side
   E: Exhaust side



3. Apply sealant to the positions (8 areas) of the upper side of the cylinder head as shown in the illustration.

   Specified sealant: MITSUBISHI GENUINE PART MD970389 or equivalent

   NOTE: Install the camshaft bearing caps, rear and camshaft bearing caps, front within 15 minutes after applying sealant.

4. Check the identification marks on the camshaft bearing cap, front so that inlet side and exhaust side cannot be mistaken in the same way as that of bearing caps No.2 – 5.

⚠ CAUTION

Then wait at least one hour. Never start the engine or let engine oil or coolant touch the adhesion surface during that time.

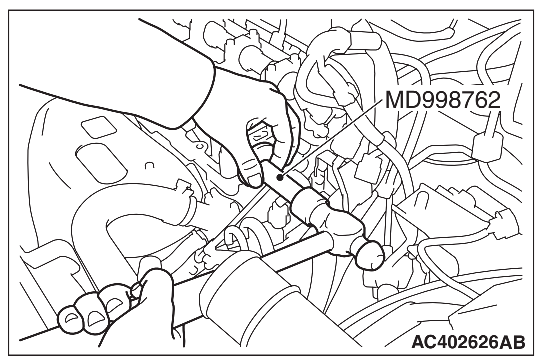
5. Tighten the bearing cap mounting bolts increasing the pressure in 2 to 3 times and finally tighten to the specified torque.

   Tightening torque:
   25 ± 1 N·m <Camshaft bearing cap, front and rear>
   11 ± 1 N·m <Camshaft bearing cap No.2 - 5>

6. Ensure that the rocker arms are installed properly.

   NOTE: Remove an excess of sealant completely.

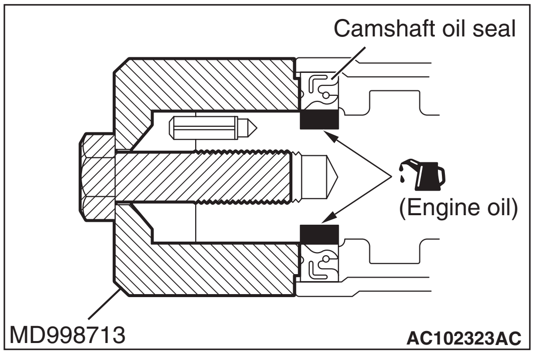
>>G<< CYLINDER HEAD CAMSHAFT END SEAL INSTALLATION



Use special tool circular packing installer (MD998762) to press-fit the cylinder head camshaft end seal as shown.

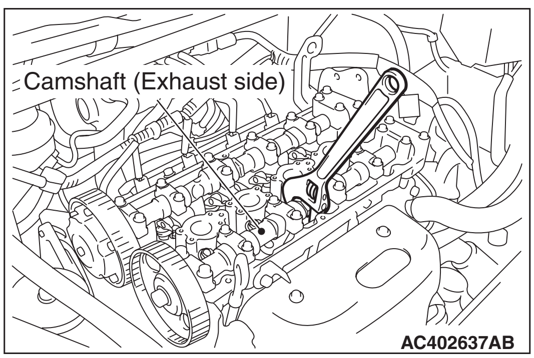
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>>H<< CAMSHAFT OIL SEAL INSTALLATION



1. Apply engine oil to the entire inner diameter of the oil seal lip.
2. Use special tool camshaft oil seal installer (MD998713) to press-fit the oil seal as shown.

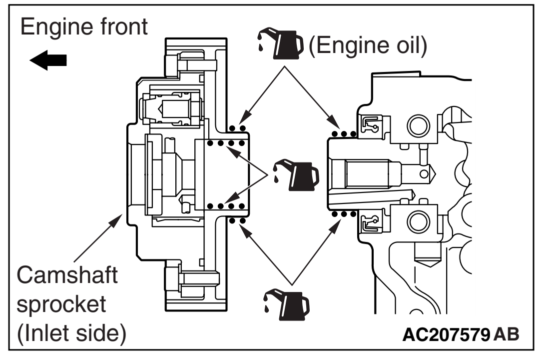
>>I<< CAMSHAFT SPROCKET (EXHAUST SIDE) INSTALLATION



1. Hold the hexagon part of the camshaft with a wrench.
2. Install the camshaft sprocket and tighten the camshaft sprocket mounting bolt to the specified torque.

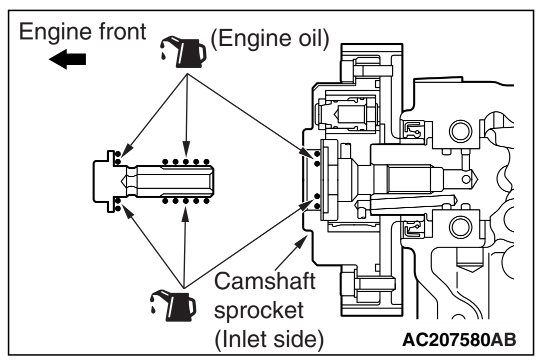
   Tightening torque: 88 ± 10 N·m

>>J<< CAMSHAFT SPROCKET (INLET SIDE) INSTALLATION



1. Apply engine oil to the tip of the camshaft and the camshaft installation side of the camshaft sprocket.
2. Align the dowel pin hole of the camshaft sprocket with the dowel pin of the camshaft, and install the camshaft sprocket to the camshaft.
3. While holding the hexagonal area of the camshaft with a wrench, check that the camshaft sprocket does not turn.

   NOTE: This is necessary, because you cannot confirm that the camshaft dowel pin is inserted into the pin hole.



4. Apply the engine oil to the threads and the face of the camshaft sprocket mounting bolt. Then fix the camshaft with a wrench in the same way as removal and tighten the camshaft sprocket mounting bolt to the specified torque.

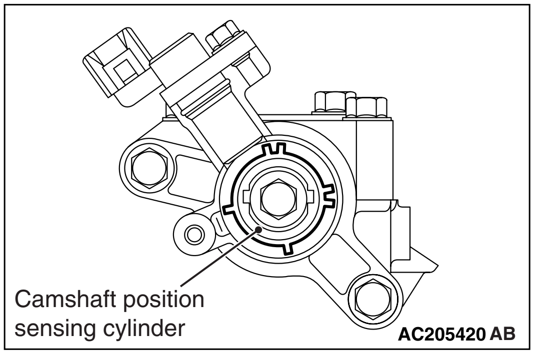
   Tightening torque: 55 ± 5 N·m

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>>K<< CAMSHAFT POSITION SENSING CYLINDER INSTALLATION

1. Set the inlet camshaft to the No.1 cylinder at compression TDC.

   NOTE: Use the force of the exhaust valve spring to rotate anti-clockwise.

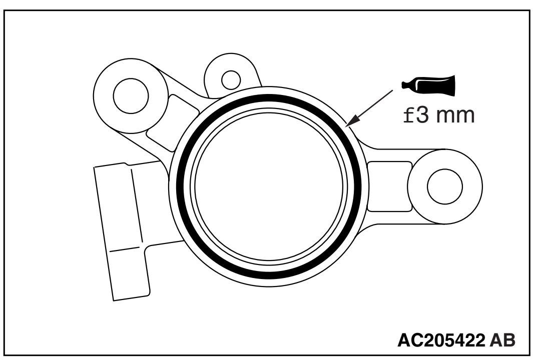


2. Install the camshaft position sensing cylinder as shown, and tighten the camshaft position sensing cylinder mounting bolt to the specified torque.

   Tightening torque: 22 ± 4 N·m

>>L<< CAMSHAFT POSITION SENSOR SUPPORT INSTALLATION

1. Remove sealant from the camshaft position sensor support and cylinder head surfaces.



2. Apply the sealant to the camshaft position sensor support flange in a continuous bead as shown in the illustration.

   Specified sealant: MITSUBISHI GENUINE PART MD970389 or equivalent

   NOTE: Install the camshaft position sensor support within 15 minutes after applying sealant.

3. Install the camshaft position sensor support to the cylinder head.

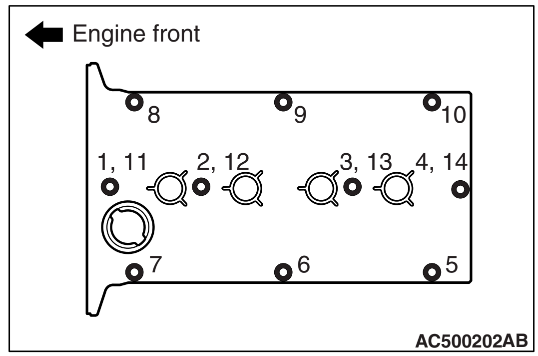
⚠ CAUTION

Then wait at least one hour. Never start the engine or let engine oil or coolant touch the adhesion surface during that time.

4. Tighten the camshaft position sensor support mounting bolts to the specified torque.

   Tightening torque: 14 ± 1 N·m

>>M<< ROCKER COVER ASSEMBLY INSTALLATION



1. Tighten the each bolt to 5.0 ± 1.0 N·m in the order (1–14) shown.
2. After tightening of step 1, tighten the each bolt to 7.0 ± 1.0 N·m in the order (1–10) shown.

>>N<< OIL CONTROL VALVE INSTALLATION

1. Apply a small amount of engine oil to the O-ring and then install it to the oil control valve.
2. Assemble the oil control valve to the cylinder head.
3. Tighten the oil control valve mounting bolt to the specified torque.

   Tightening torque: 11 ± 1 N·m

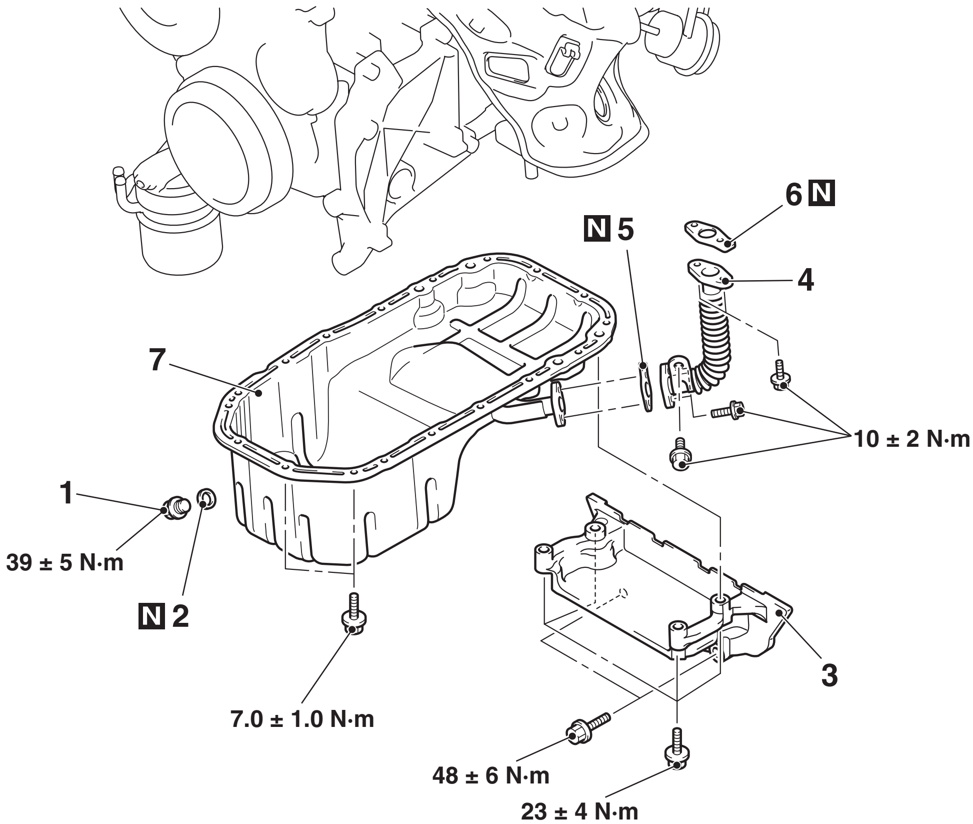
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Group TOC

OIL PAN

REMOVAL AND INSTALLATION

M1112002801540

Pre-removal Operation	Post-installation Operation
• Engine Oil Draining (Refer to GROUP 12, On-vehicle Service – Engine Oil Replacement P.12-4). • Front Catalytic Converter Assembly Removal (Refer to GROUP 17, Emission Control – Catalytic Converter P.17-24).	• Front Catalytic Converter Assembly Installation (Refer to GROUP 17, Emission Control – Catalytic Converter P.17-24). • Engine Oil Refilling (Refer to GROUP12, On-vehicle Service – Engine Oil Replacement P.12-4).



Removal steps

1. Engine oil pan drain plug
2. >>E<< Engine oil pan drain plug gasket
3. >>D<< Transmission housing front lower cover stay
4. Turbocharger oil return tube

Removal steps (Continued)

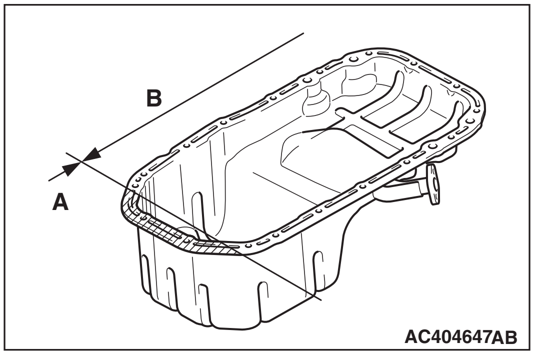
5. >>C<< Turbocharger oil return tube gasket (oil pan side)
6. >>B<< Turbocharger oil return tube gasket (turbocharger assembly side)
7. <<A>> >>A<< Engine oil pan

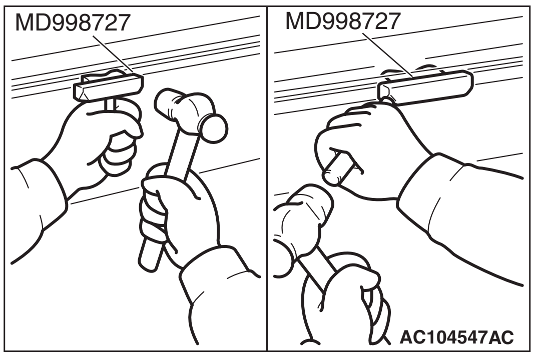
Main Index
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REMOVAL SERVICE POINT

<<A>> ENGINE OIL PAN REMOVAL

⚠ CAUTION





Do not use special tool oil pan FIPG cutter (MD998727) in area A of the engine oil pan. Using the special tool in area A may cause deformation of the front case because the front case is made of aluminium.

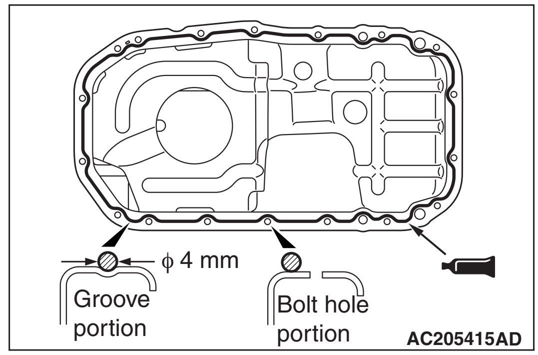
1. Tap the special tool MD998727 into the range (B) between the cylinder block and the engine oil pan, and then slide the tool sideways.

   NOTE: If any sounding parts interfere with the removal, there is no need to use the special tool.
2. Remove the engine oil pan.

INSTALLATION SERVICE POINTS

>>A<< ENGINE OIL PAN INSTALLATION

1. Remove sealant from the engine oil pan, front case and cylinder block surfaces.



2. Apply a bead of the sealant to the cylinder block mating surface of the engine oil pan as shown.

   Specified sealant: MITSUBISHI GENUINE PART MD970389 or equivalent

   NOTE: Install the engine oil pan within 15 minutes after applying sealant.
3. Assemble the engine oil pan to the cylinder block.

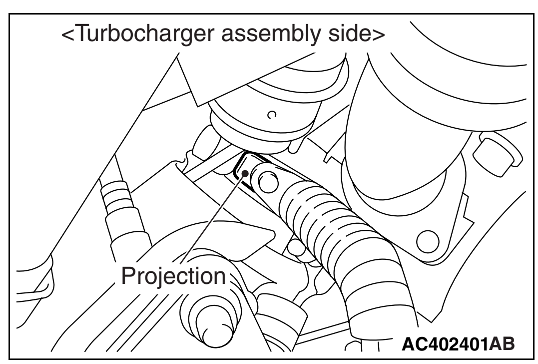
⚠ CAUTION

Wait at least one hour. Never start the engine or let engine oil or coolant touch the sealant surface during that time.

4. Tighten the engine oil pan mounting bolts to the specified torque.

   Tightening torque: 7.0 ± 1.0 N·m

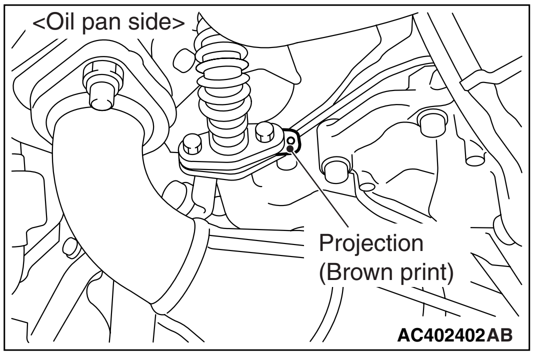
>>B<< TURBOCHARGER OIL RETURN TUBE GASKET (TURBOCHARGER ASSEMBLY SIDE) INSTALLATION



Install the gasket as its protrusion is in the direction shown.

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Group TOC

>>C<< TURBOCHARGER OIL RETURN TUBE GASKET (OIL PAN SIDE) INSTALLATION



With the print area on the gasket facing to the pipe, install the gasket so that the protrusion is in the direction shown in the figure.

>>D<< TRANSMISSION HOUSING FRONT LOWER COVER STAY INSTALLATION

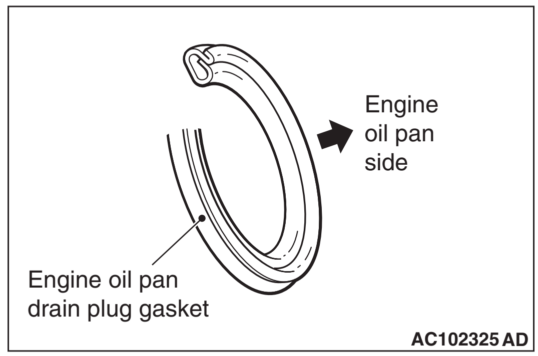
Install the transmission housing front lower cover stay as follows.

1. Tighten four mounting bolts of the engine side by hand.
2. Tighten two mounting bolts of the transmission side to the specified torque.

   Tightening: 48 ± 6 N·m
3. Tighten four mounting bolts of the engine side to the specified torque.

   Tightening: 23 ± 4 N·m

>>E<< ENGINE OIL PAN DRAIN PLUG GASKET INSTALLATION



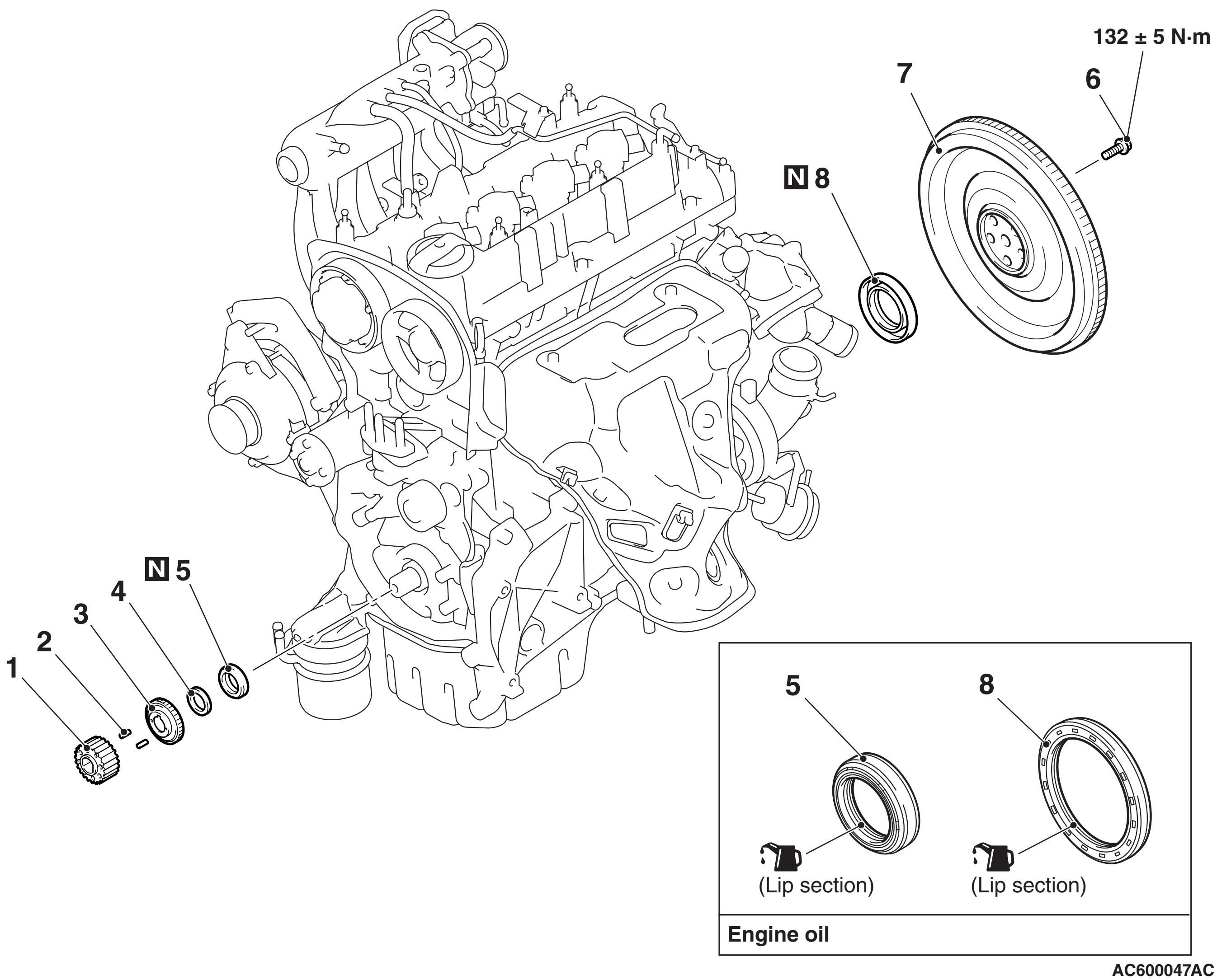
Replace the gasket with a new gasket. Install the new gasket in the direction shown in the illustration.

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Group TOC

CRANKSHAFT OIL SEAL

REMOVAL AND INSTALLATION

M1112003101395



Crankshaft front oil seal removal steps

- Valve timing belt (Refer to P.11C-37).

>>**D**<<	1.	Crankshaft camshaft drive sprocket
>>**D**<<	2.	Timing belt train spring pin
>>**D**<<	3.	Crankshaft angle sensing blade
>>**D**<<	4.	Timing belt train spacer
>>**C**<<	5.	Crankshaft front oil seal

Crankshaft rear oil seal removal steps

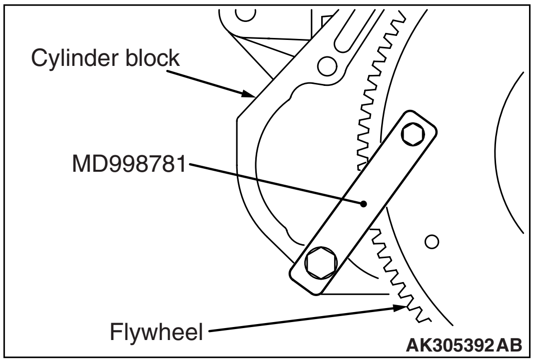
- Transmission assembly (Refer to GROUP 22A, Transmission Assembly P.22A-7).
- Clutch cover and clutch disc (Refer to GROUP 21B, Clutch P.21B-3).

<<**A**>>	>>**B**<<	6.	Flywheel bolt
		7.	Flywheel
	>>**A**<<	8.	Crankshaft rear oil seal

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Group TOC

REMOVAL SERVICE POINT

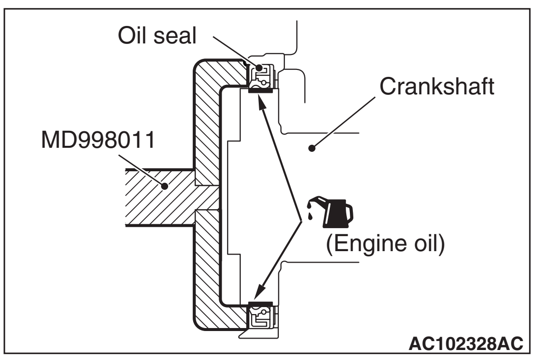
<<A>> FLYWHEEL BOLT REMOVAL



1. Use special tool flywheel stopper (MD998781) to secure the flywheel.
2. Remove the flywheel bolts.

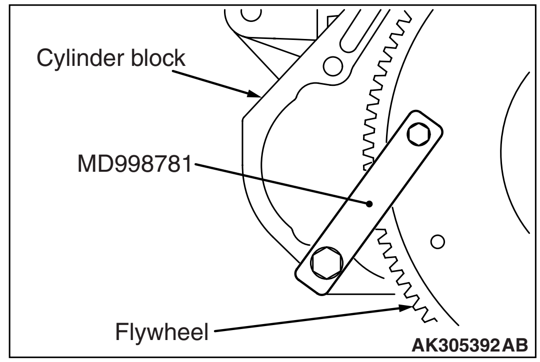
INSTALLATION SERVICE POINTS

>>A<< CRANKSHAFT REAR OIL SEAL INSTALLATION



1. Apply a small amount of new engine oil to the entire inner diameter of the oil seal lip.
2. Use following special tool crankshaft rear oil seal installer (MD998011) to press-fit the oil seal.

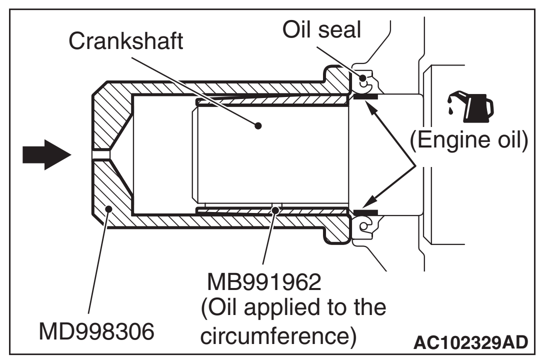
>>B<< FLYWHEEL BOLT INSTALLATION



1. Use special tool flywheel stopper (MD998781) to secure the flywheel in the same manner as removal.
2. Tighten the flywheel bolts to the specified torque in a crisscross pattern.

   Tightening torque: 132 ± 5 N·m

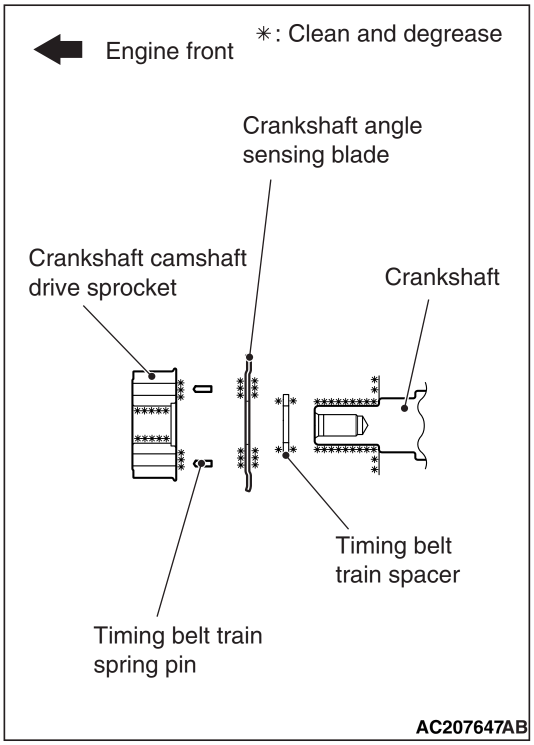
>>C<< CRANKSHAFT FRONT OIL SEAL INSTALLATION



1. Apply a small amount of engine oil to the outer diameter of special tool crankshaft front oil seal guide (MB991962) and install it to the crankshaft.
2. Apply a small amount of engine oil to the entire inner diameter of the oil seal lip.
3. Use special tool crankshaft front oil seal installer (MD998306) to press-fit the oil seal.

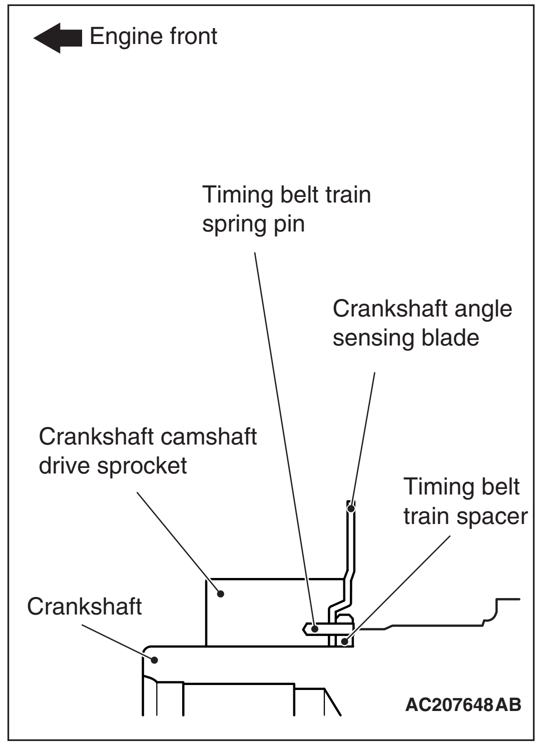
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Group TOC

>>D<< TIMING BELT TRAIN SPACER/CRANKSHAFT ANGLE SENSING BLADE/TIMING BELT TRAIN SPRING PIN/CRANKSHAFT CAMSHAFT DRIVE SPROCKET INSTALLATION



1. Clean and degrease the installation side of the crankshaft camshaft drive sprocket, the crankshaft angle sensing blade, the timing belt train spacer and the crankshaft.

NOTE: De-grease to prevent drop in friction factor in the presser area due to grease.



2. Install the crankshaft camshaft drive sprocket, the timing belt train spring pin, the crankshaft angle sensing blade and the timing belt train spacer to the crankshaft. Then install the crankshaft in the direction shown.

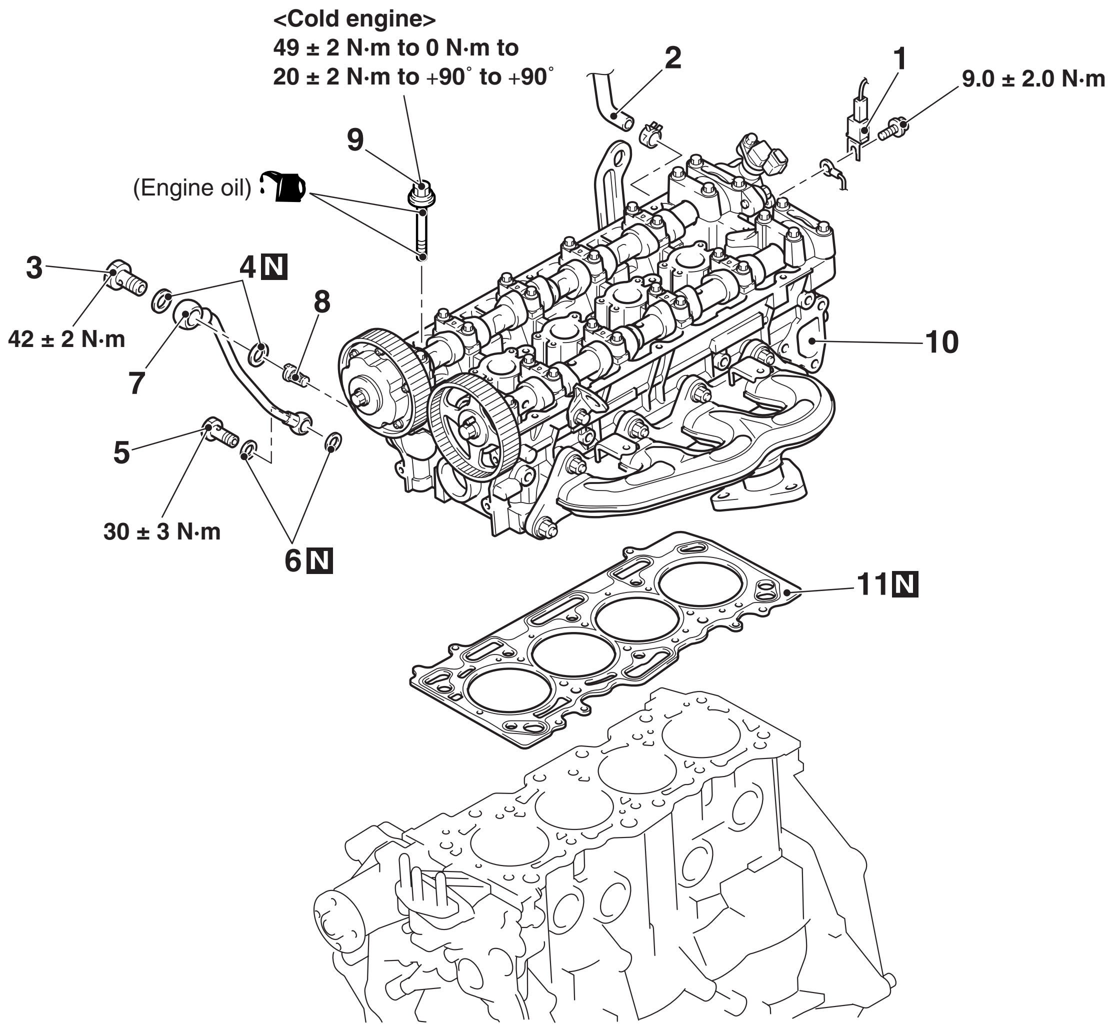
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Group TOC

CYLINDER HEAD GASKET

REMOVAL AND INSTALLATION

M1112004002037

Pre-removal Operation	Post-installation Operation
• Fuel Line Pressure Reduction [Refer to GROUP 13B, On-vehicle Service – Fuel Pump Connector Disconnection (How to Reduce Pressurized Fuel Lines) P.13B-360]. • Engine Coolant Draining (Refer to GROUP 14, On-vehicle Service – Engine Coolant Replacement P.14-6). • Engine Oil Draining (Refer to GROUP 12, On-vehicle Service – Engine Oil Replacement P.12-4). • Inlet Manifold Removal (Refer to GROUP 15, Inlet Manifold P.15-12). • Water Pump Inlet Pipe Removal (Refer to GROUP 14, Water Hose and Water Pipe P.14-18). • Ignition Coil Removal (Refer to GROUP 16, Ignition System – Ignition Coil P.16-37). • Valve Timing Belt Removal (Refer to P.11C-37). • Rocker Cover Assembly Removal (Refer to P.11C-20).	• Rocker Cover Assembly Installation (Refer to P.11C-20). • Valve Timing Belt Installation (Refer to P.11C-37). • Ignition Coil Installation (Refer to GROUP 16, Ignition System – Ignition Coil P.16-37). • Water Pump Inlet Pipe Installation (Refer to GROUP 14, Water Hose and Water Pipe P.14-18). • Inlet Manifold Installation (Refer to GROUP 15, Inlet Manifold P.15-12). • Engine Oil Refilling (Refer to GROUP 12, On-vehicle Service – Engine Oil Replacement P.12-4). • Engine Coolant Refilling (Refer to GROUP 14, On-vehicle Service – Engine Coolant Replacement P.14-6). • Fuel Leak Check



AC402493AD

Removal steps

- Engine mounting insulator (Refer to GROUP 32, Engine Mounting P.32-6).

1. Noise condenser
2. Heater piping hose connection

Removal steps (Continued)

- Alternator brace (Refer to GROUP 16, Charging System – Alternator P.16-14).

3. Eye bolt
4. Gasket

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Removal steps (Continued)

5. Eye bolt
6. Gasket
7. Oil feeder control valve pipe
8. Filter

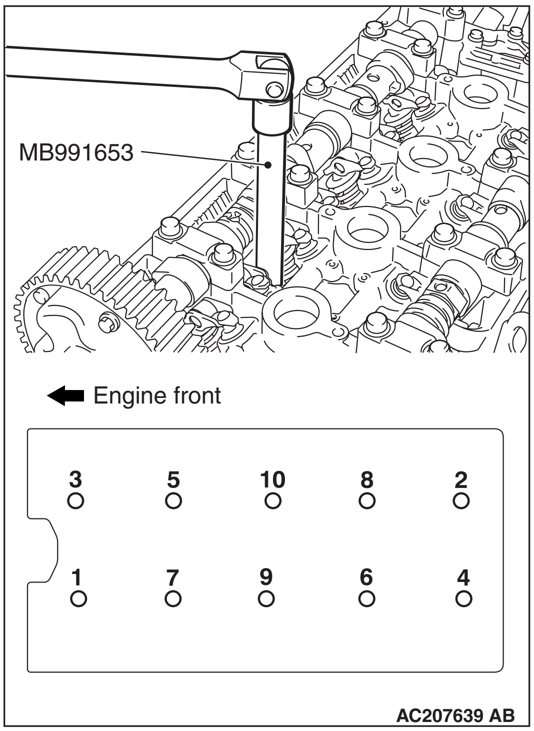
<<**A**>> >>**B**<< 9. Cylinder head bolts

10. Cylinder head assembly

>>**A**<< 11. Cylinder head gasket

REMOVAL SERVICE POINT

<<A>> CYLINDER HEAD BOLTS REMOVAL



Use special tool cylinder head bolt wrench (MB991653) to loosen the cylinder head bolts in two or three steps in the order of the numbers shown in the illustration.

NOTE: If the cylinder head bolts cannot be pulled out due to the washer being trapped in the valve spring, raise the bolt slightly, then remove it while holding it by using a magnet.

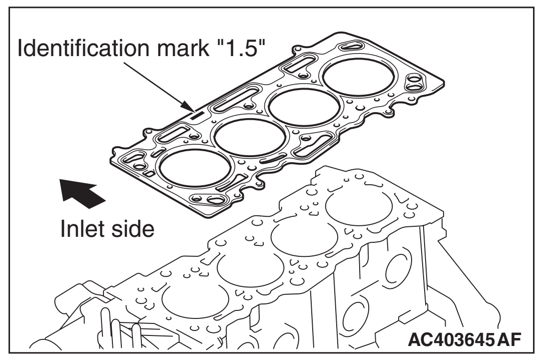
INSTALLATION SERVICE POINTS

>>A<< CYLINDER HEAD GASKET INSTALLATION

⚠ CAUTION

Do not allow any foreign materials get into the coolant passages, oil passages and cylinder.

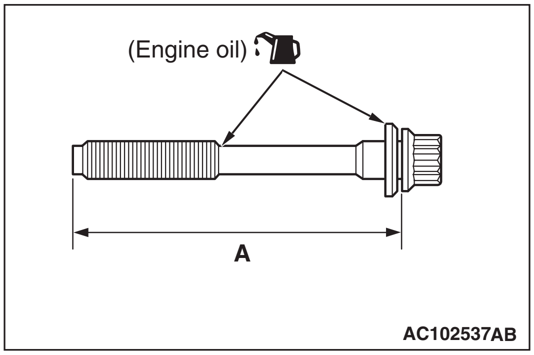
1. Degrease the cylinder head gasket mounting surface.



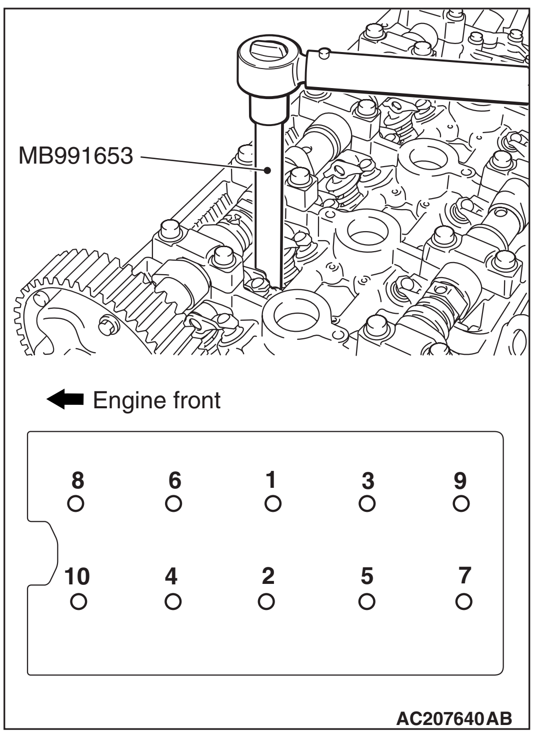
2. Assemble to the cylinder block so the cylinder head gasket identification mark of "1.5" is at the top surface and on the inlet side.

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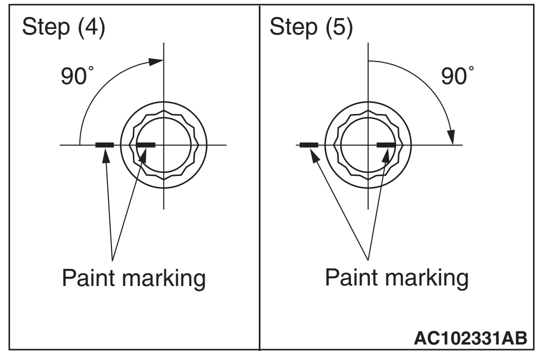
>>B<< CYLINDER HEAD BOLTS INSTALLATION



1. Check that the nominal length of each cylinder head bolt meets the limit. If it exceeds the limit, replace the bolts with a new one.
   Limit (A): 103.2 mm
2. Apply a small amount of engine oil to the thread of the bolts and to the washers.



3. Use special tool cylinder head bolt wrench (MB991653) to tighten the cylinder head bolts in the following procedures.
   (1) Tighten the bolts to 49 ± 2 N·m in the order shown.
   (2) Loosen the bolts fully in the reverse sequence to that shown.
   (3) Tighten the bolts to 20 ± 2 N·m in the order shown.



   (4) Apply a paint mark to the heads of the cylinder head bolts and cylinder head, then tighten 90 degree angle as shown.

⚠ CAUTION
- **The bolt is not tightening sufficiently if the tightening angle is less than a 90 degree angle.**
- **If the tightening angle exceeds the standard specification, remove the bolt and start over from step 1.**

   (5) Tighten in a 90 degree angle as shown in the instructions of the figure, then check to see that the paint mark on the head of the cylinder head bolts and the paint mark on the cylinder head is on a linear line.

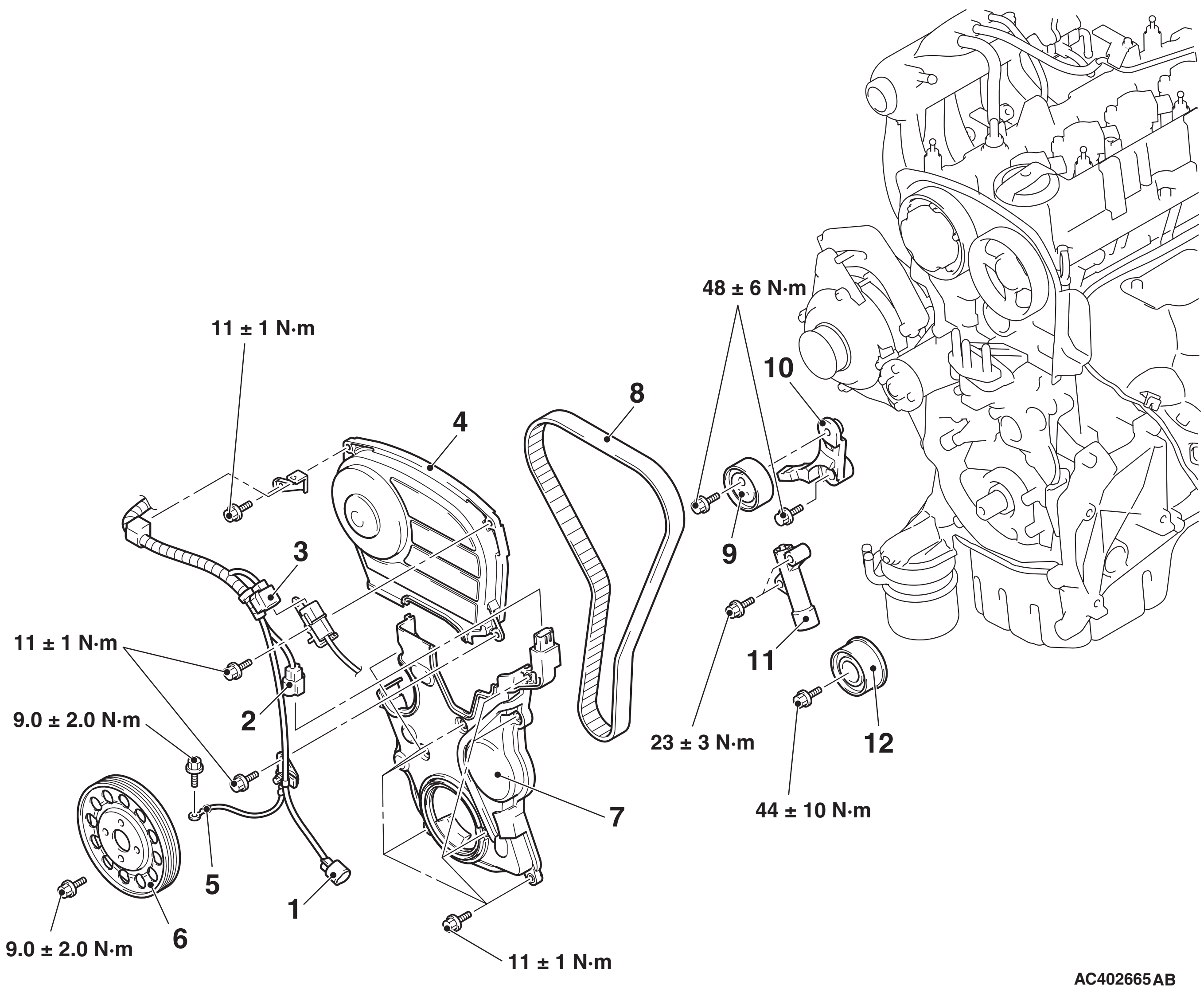
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Group TOC

TIMING BELT

REMOVAL AND INSTALLATION

M1112004301637

Pre-removal Operation	Post-installation Operation
• Front Under Cover Panel Removal (Refer to GROUP 51, Front Bumper Assembly and Radiator Grille P.51-2). • Side Under Cover Panel (RH) Removal (Refer to GROUP 51, Front Bumper Assembly and Radiator Grille P.51-2). • Crankshaft Pulley Removal (Refer to P.11C-17).	• Crankshaft Pulley Installation (Refer to P.11C-17). • Drive Belt Tension Check and Adjustment (Refer to P.11C-8). • Side Under Cover Panel (RH) Installation (Refer to GROUP 51, Front Bumper Assembly and Radiator Grille P.51-2). • Front Under Cover Panel Installation (Refer to GROUP51, Front Bumper Assembly and Radiator Grille P.51-2).



Removal steps

1. A/C compressor connector
2. Crank angle sensor connector
3. Oxygen sensor connector
4. Timing belt upper cover
- Engine mounting insulator (Refer to GROUP 32, Engine Mounting P.32-6).
5. Earth cable connection

Removal steps (Continued)

6. Water pump pulley
7. Timing belt lower cover

>>D<< • Valve timing belt tension adjustment <Installation only>

<<A>> >>C<< 8. Valve timing belt

>>B<< 9. Timing belt tensioner pulley

10. Timing belt tensioner arm

>>A<< 11. Timing belt tensioner adjuster

12. Timing belt idler pulley

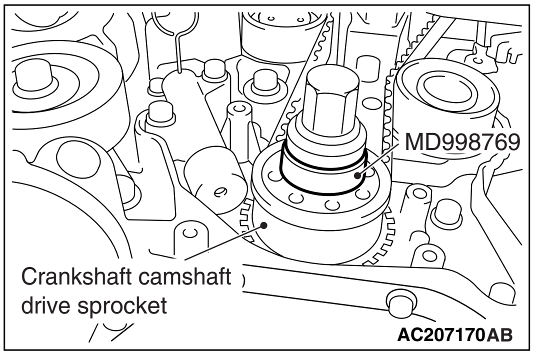
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REMOVAL SERVICE POINT

<<A>> VALVE TIMING BELT REMOVAL

⚠ CAUTION

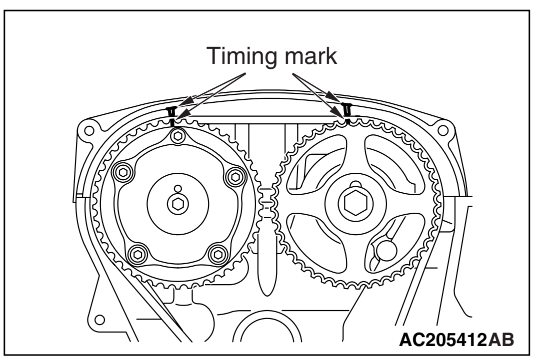
Be sure to use special tool crankshaft sprocket spacer (MD998769) when installing the crankshaft pulley centre bolt to the crankshaft. If the bolt is installed directly to the crankshaft, the tip of the bolt and the thread of the crankshaft may be damaged.



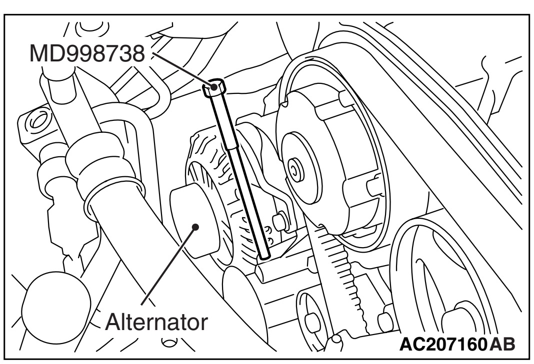
1. Set the special tool, the crankshaft pulley washer and the crankshaft pulley centre bolt to the crankshaft camshaft drive sprocket.

⚠ CAUTION

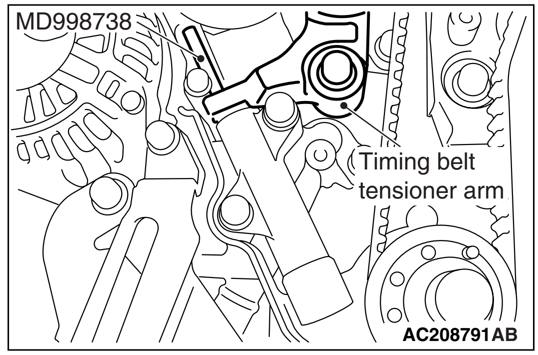
Never turn the crankshaft anti-clockwise.



2. Turn the crankshaft clockwise, align each timing mark to set No.1 cylinder to TDC of its compression stroke.



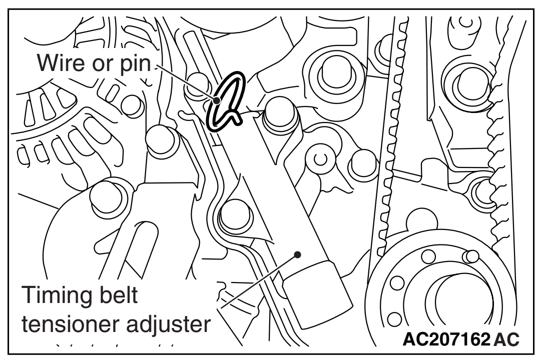
3. Remove the timing belt under cover rubber plug and then set special tool adjusting bolt (MD998738).



4. Screw in the special tool with hands until it contacts the timing belt tensioner arm.

⚠ CAUTION

The special tool can be gradually installed at a rate of a 30 degree turn per second. If it is screwed in all at once, the timing belt tensioner adjuster rod will not easily retract and the special tool may bend.



5. Gradually screw in the special tool. Then align the timing belt tensioner adjuster rod set hole with the timing belt tensioner adjustor cylinder set hole, and insert a wire or a pin.

⚠ CAUTION

To reuse the valve timing belt, draw an arrow indicating the rotating direction (clockwise) on the back of the belt using chalk, etc.

6. After removal of the special tool, loosen the timing belt tensioner pulley mounting bolts and remove the valve timing belt.

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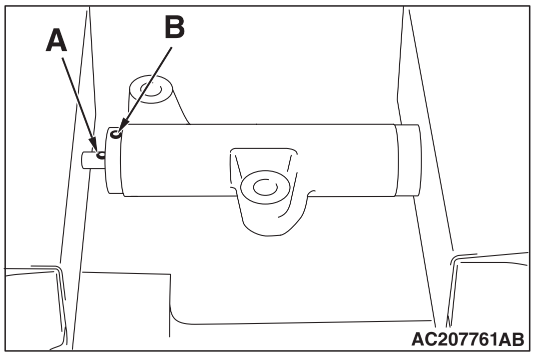
INSTALLATION SERVICE POINTS

>>A<< TIMING BELT TENSIONER ADJUSTER INSTALLATION

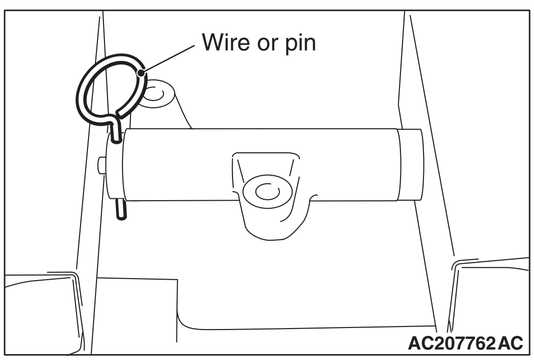
1. Set according to the following procedures when the timing belt tensioner adjuster rod is fully extended.

⚠ CAUTION

If the compression is too fast the procedure may damage the rod. Make a point to slowly and thoroughly compress.



(1) Slowly compress the timing belt tensioner adjuster rod using a press or vice, then align the set hole A of the rod with set hole B of the timing belt tensioner adjuster cylinder.



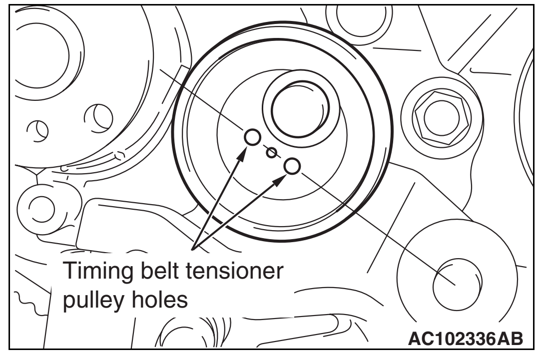
(2) Insert a wire or pin in the set hole aligned.

NOTE: . When replacing the timing belt tensioner adjuster with new parts, the timing belt tensioner adjuster is set with a pin.

2. Install the timing belt tensioner adjuster to the engine and then tighten the mounting bolts to the specified torque. Do not remove the wire or pin until the tension of the valve timing belt is adjusted.

Tightening torque: 23 ± 3 N·m

>>B<< TIMING BELT TENSIONER PULLEY INSTALLATION



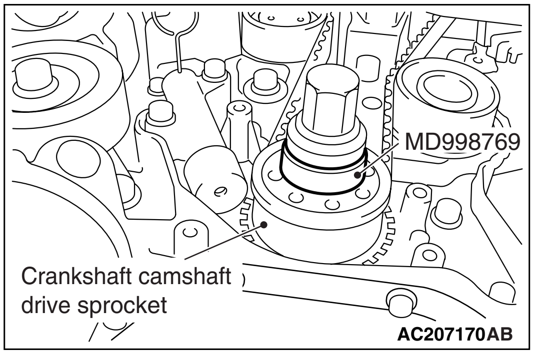
Temporarily tighten the timing belt tensioner pulley as shown.

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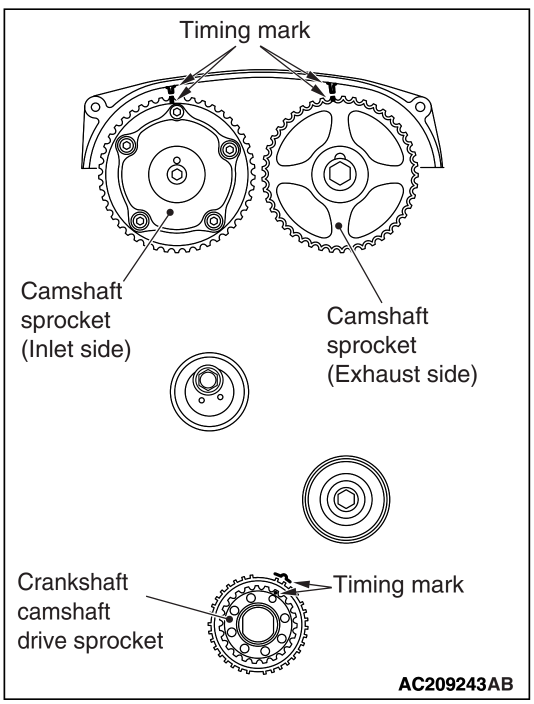
>>C<< VALVE TIMING BELT INSTALLATION

⚠ CAUTION

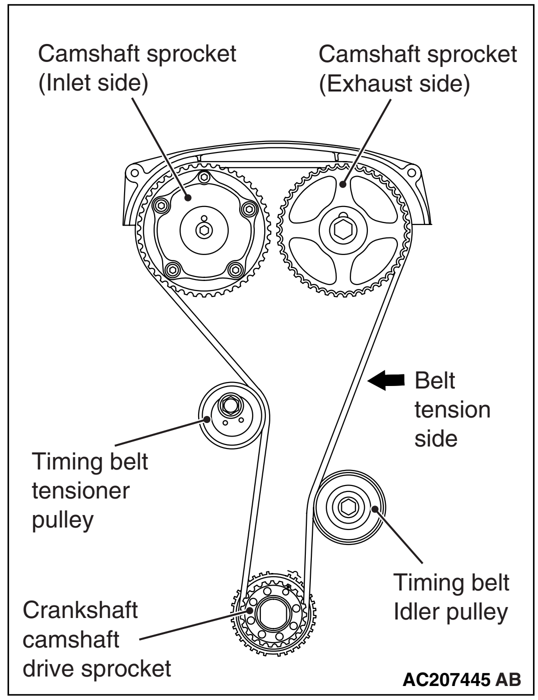
Be sure to use special tool crankshaft sprocket spacer (MD998769) when installing the crankshaft pulley centre bolt to the crankshaft. If the bolt is installed directly to the crankshaft, the tip of the bolt and the thread of the crankshaft may be damaged.



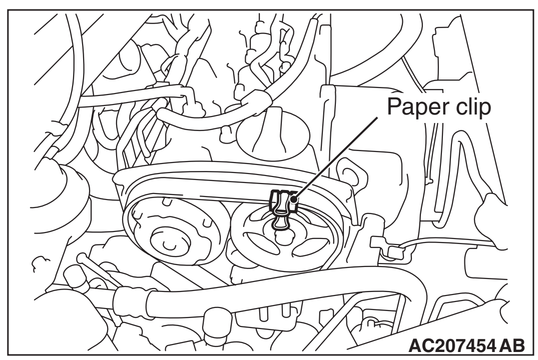
1. Set the special tool, the crankshaft pulley washer and the crankshaft pulley centre bolt to the crankshaft camshaft drive sprocket.



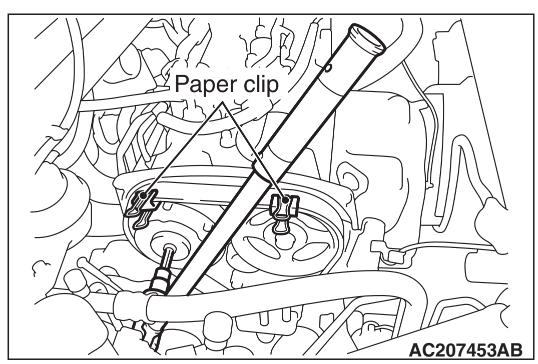
2. Align the timing marks on the camshaft sprocket and crankshaft camshaft drive sprocket.



3. Incorporate the valve timing belt in the following manner so that the tensile force of the belt is not lax.
   (1) Pass the valve timing belt around the crankshaft camshaft drive sprocket and the timing belt idler pulley in that order.



   (2) Pass the valve timing belt around the camshaft sprocket (exhaust side), and fix it with a paper clip as shown.



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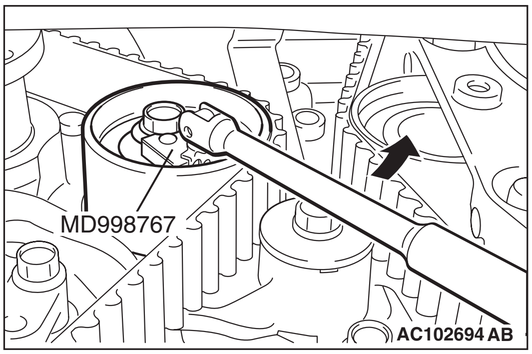
(3) Pass the valve timing belt around the camshaft sprocket (inlet side) while aligning the timing marks on the rocker cover and the camshaft sprocket with a wrench. Then, fix the belt with paper clips as shown.

(4) Pass the valve timing belt around the timing belt tensioner pulley.

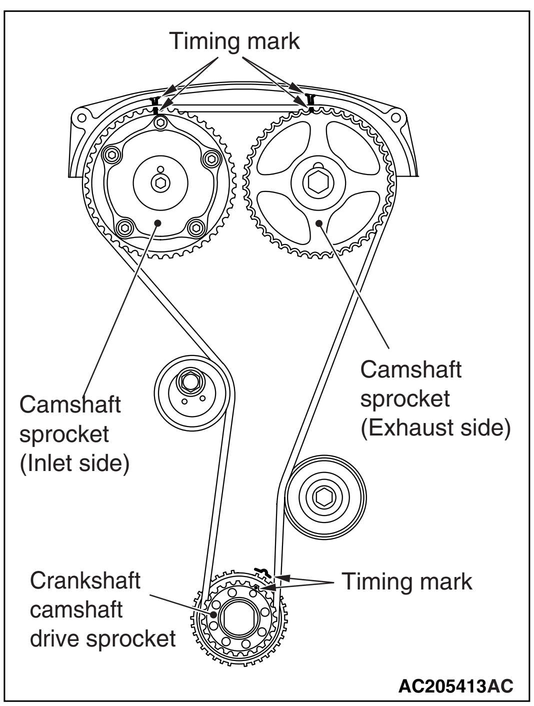
⚠ CAUTION

Incorporate the valve timing belt. Then apply reverse rotation (anti-clockwise rotation) pressure to the camshaft sprocket. Re-check to see that each timing mark is aligned while the tension side of the belt is right.

(5) Remove the two paper clips.

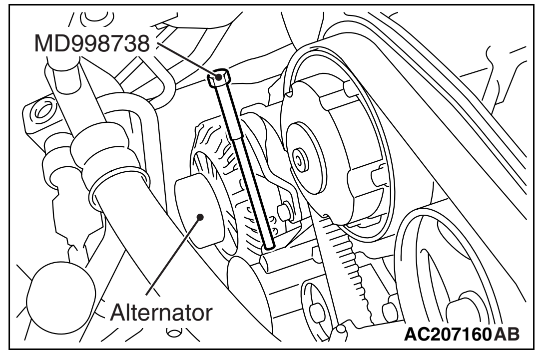


4. Using special tool tensioner wrench (MD998767), turn the timing belt tensioner pulley in the direction shown to apply tension to the valve timing belt. Then tighten the timing belt tensioner pulley mounting bolts temporarily to fix the timing belt tensioner pulley.



5. Check that the timing marks are aligned.
6. Adjust the valve timing belt tension.

>>D<< VALVE TIMING BELT TENSION ADJUSTMENT

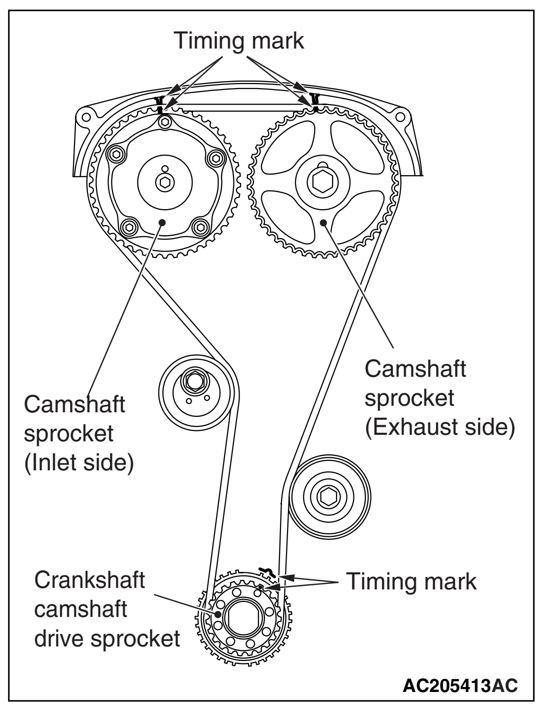


1. Set special tool adjusting bolt (MD998738) used when removing the valve timing belt.

⚠ CAUTION

Always screw in the special tool in with your hands, since use of a spanner or other tools may damage the wire or pin inserted in the timing belt tensioner adjuster.

2. Gradually screw in the special tool to a position in which the wire or pin inserted in the timing belt tensioner adjuster lightly moves.
3. Gradually screw in the special tool to a position in which the wire or pin inserted in the timing belt tensioner adjuster lightly moves.
4. Turn the crankshaft 1/4 of a revolution in the anti-clockwise direction.

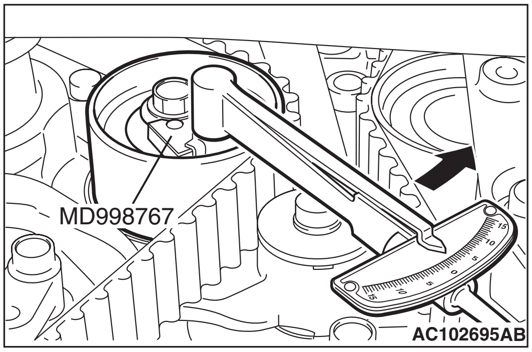


5. Turn the crankshaft in the clockwise direction, align each timing mark to set No.1 cylinder to TDC of its compression stroke.

6. Loosen the timing belt tensioner pulley mounting bolt.

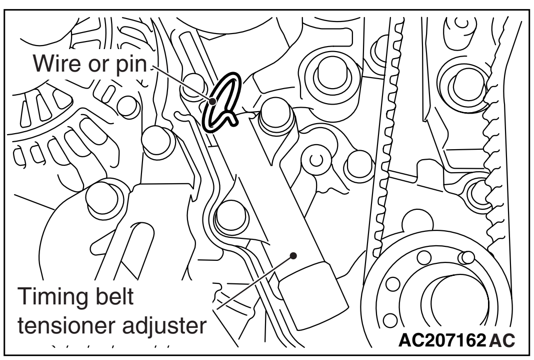
⚠ CAUTION

When tightening the mounting bolt, ensure that the timing belt tensioner pulley does not rotate with the bolt. Allowing it to rotate with the bolt can cause deficient tension of the belt.

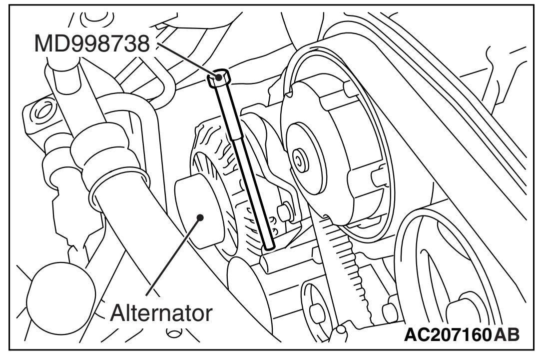


7. With special tool tensioner wrench (MD998767) and torque wrench, apply tension torque 0.8 N·m to the valve timing belt, and tighten the timing belt tensioner pulley mounting bolt to the specified torque.

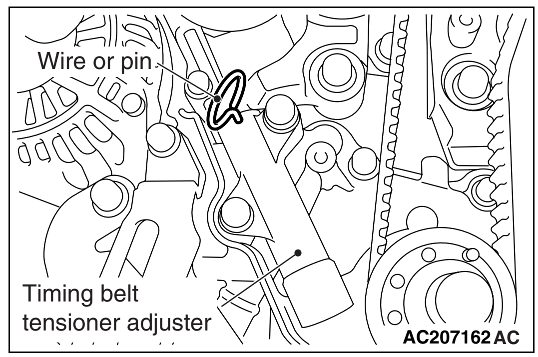
Tightening torque: 48 ± 6 N·m

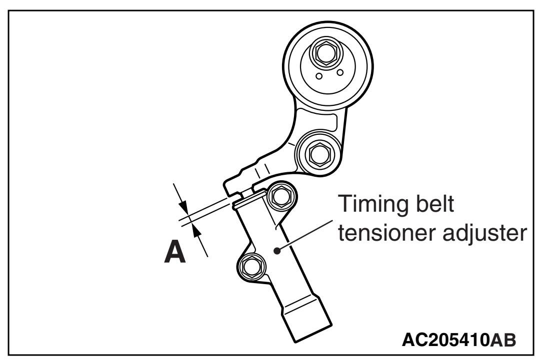


8. Remove wire or pin inserted to timing belt tensioner adjuster.



9. Remove the special tool adjusting bolt (MD998738), and install the rubber plug to the timing belt under cover.
10. Rotate crankshaft clockwise two turns, and leave it for about 15 minutes.



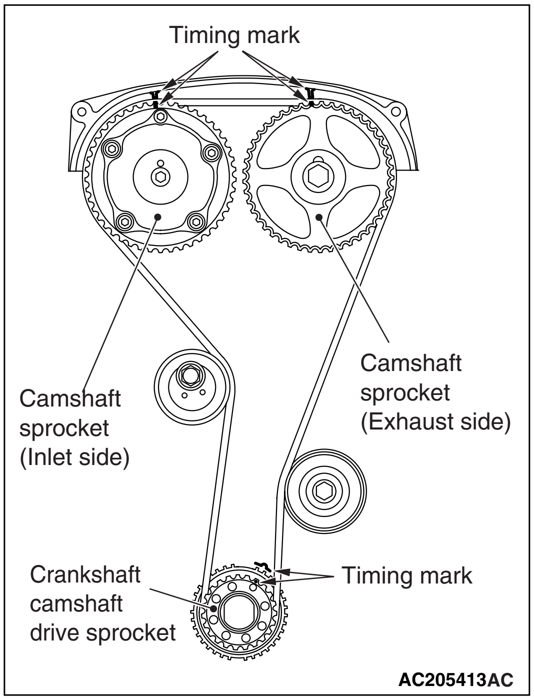


11. Insert wire or pin removed in Step 7 again, and ensure that it can be pulled out with a light load. When wire or pin can be lightly removed, appropriate tension is applied on timing belt. In this case, remove wire or pin. Also the projection of timing belt tensioner adjuster rod (A) is within the standard value, appropriate tension is applied.

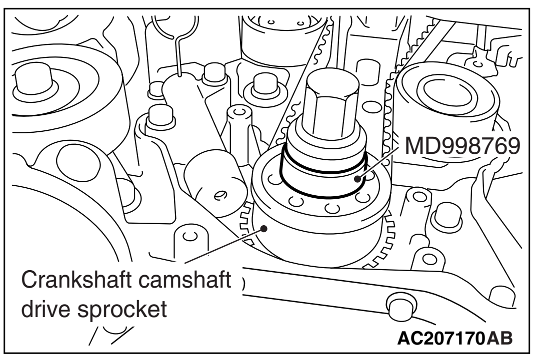
Standard value (A): 4.8 – 5.5 mm

12. If wire or pin cannot be easily pulled out, repeat Step 1 through Step 9 to reach proper valve timing belt tension.

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13.Check that the timing marks are aligned.



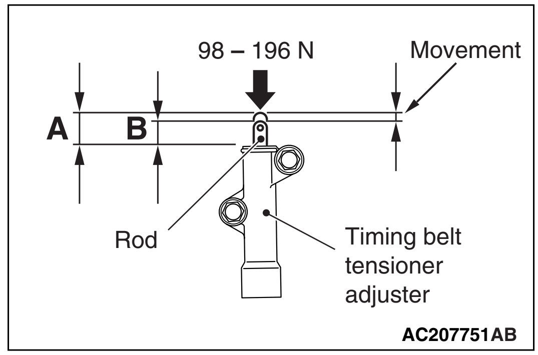
14.Remove special tool crankshaft sprocket spacer (MD998769), the crankshaft pulley washer and the crankshaft pulley centre bolt.

INSPECTION

M1112004400631

TIMING BELT TENSIONER ADJUSTER CHECK

1. Check for oil leak from seal, and replace it if leak is detected.
2. Check for wear or damage at the top of the rod. Replace it, if required.



3. Hold the timing belt tensioner adjuster by hand, and press top end of the rod onto the metal (e.g. cylinder block) under a pressure of 98 – 196 N to measure the movement of the rod.

   Standard value: Within 1 mm

   A: Length when it is free (not pressed)
   B: Length when it is pressed
   A – B: Movement
4. If the measured value is out of the standard value, replace the timing belt tensioner adjuster.

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ENGINE ASSEMBLY

REMOVAL AND INSTALLATION

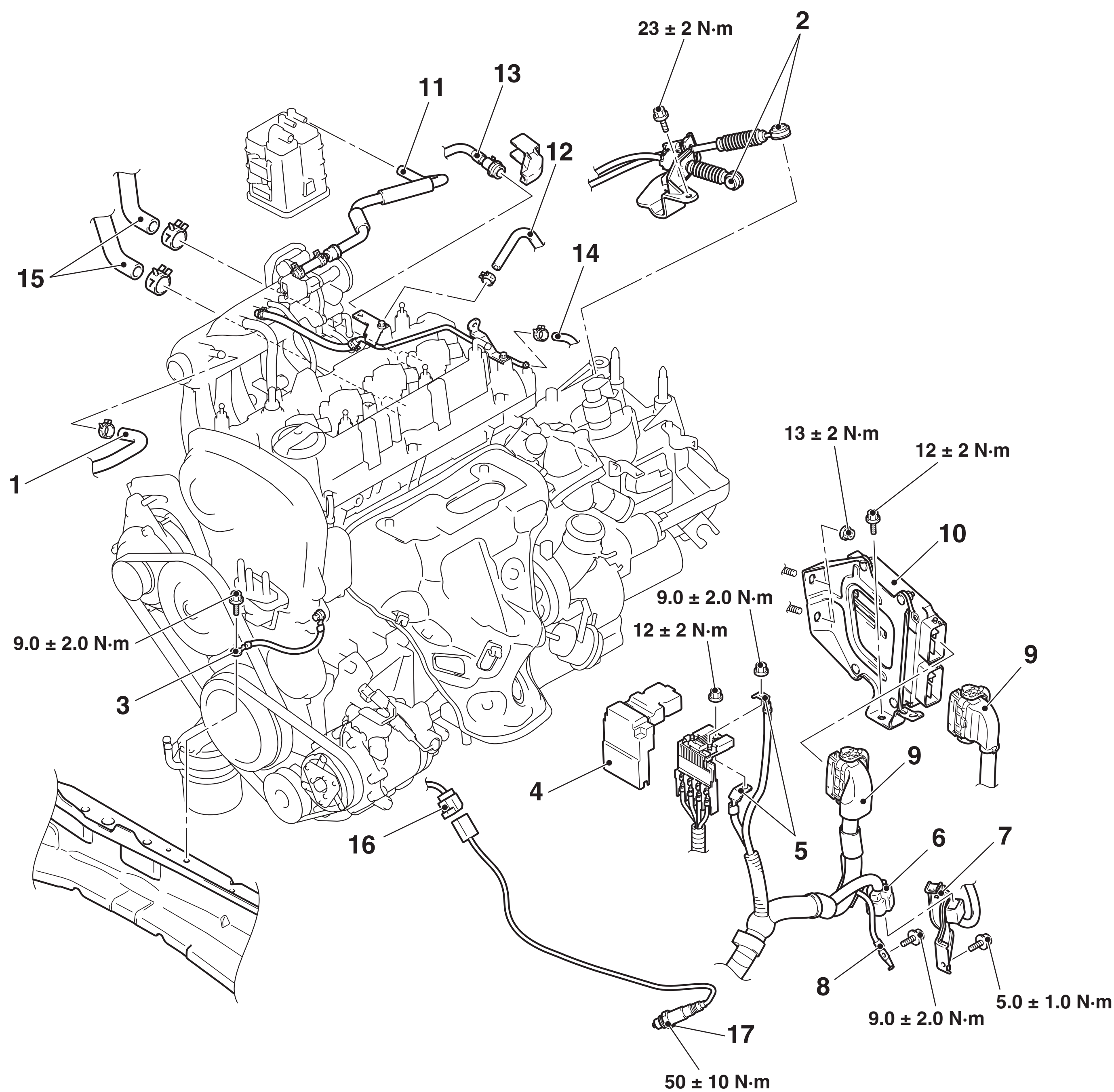
M1112001002931

⚠ CAUTION

When the engine assembly replacement is performed, use the M.U.T.-III to initialize the learning value (Refer to GROUP 00, Precautions Before Service – Initialization Procedure for Learning Value in MPI Engine P.00-20).

Pre-removal Operation	Post-installation Operation
• Fuel Discharger Prevention [Refer to GROUP 13B, On-vehicle Service – Fuel Pump Connector Disconnection (How to Reduce Pressurized Fuel Lines) P.13B-360]. • Engine Coolant Draining (Refer to GROUP 14, On-vehicle Service – Engine Coolant Replacement P.14-6). • Engine Oil Draining (Refer to GROUP 12, On-vehicle Service – Engine Oil Replacement P.12-4). • Transmission Oil Draining (Refer to GROUP 22A, On-vehicle Service – Transmission Oil Replacement P.22A-4). • Front Under Cover Panel Removal (Refer to GROUP 51, Front Bumper Assembly and Radiator Grille P.51-2). • Side Under Cover Panel Removal (Refer to GROUP 51, Front Bumper Assembly and Radiator Grille P.51-2). • Air Intake Duct and Air Cleaner Assembly and Engine Air Intake Duct Removal (Refer to GROUP 15, Air Cleaner P.15-6). • Front Bumper Assembly Removal (Refer to GROUP 51, Front Bumper Assembly and Radiator Grille P.51-2). • Intercooler Assembly Removal (Refer to GROUP 15, Intercooler Assembly P.15-8). • Battery and Battery Tray Removal • Cowl Top Panel Removal (Refer to GROUP 42, Loose Panel P.42-81). • Strut Tower Bar Removal (Refer to GROUP 42, Strut Tower Bar P.42-11). • Radiator Assembly Removal (Refer to GROUP 14, Radiator P.14-22). • Drive Shaft Removal (Refer to GROUP 26, Drive Shaft Assembly P.26-16). • Front Exhaust Pipe Removal (Refer to GROUP 15, Exhaust Pipe and Main Muffler P.15-21). • Front Catalytic Converter Assembly Removal (Refer to GROUP 17, Emission Control – Catalytic Converter P.17-24). • Engine Roll Stopper Rod Assembly Removal (Refer to GROUP 32, Engine Roll Stopper Rod P.32-11).	• Engine Roll Stopper Rod Assembly Installation (Refer to GROUP 32, Engine Roll Stopper Rod P.32-11). • Front Catalytic Converter Assembly Installation (Refer to GROUP 17, Emission Control – Catalytic Converter P.17-24). • Front Exhaust Pipe Installation (Refer to GROUP 15, Exhaust Pipe and Main Muffler P.15-21). • Drive Shaft Installation (Refer to GROUP 26, Drive Shaft Assembly P.26-16). • Radiator Assembly Installation (Refer to GROUP 14, Radiator P.14-22). • Strut Tower Bar Installation (Refer to GROUP 42, Strut Tower Bar P.42-11). • Cowl Top Panel Installation (Refer to GROUP 42, Loose Panel P.42-81). • Battery and Battery Tray Installation • Intercooler Assembly Installation (Refer to GROUP 15, Intercooler Assembly P.15-8). • Front Bumper Assembly Installation (Refer to GROUP 51, Front Bumper Assembly and Radiator Grille P.51-2). • Air Intake Duct and Air Cleaner Assembly and Engine Air Intake Duct Installation (Refer to GROUP 15, Air Cleaner P.15-6). • Transmission Oil Refilling (Refer to GROUP 22A, On-vehicle Service – Transmission Oil Replacement P.22A-4). • Engine Oil Refilling (Refer to GROUP 12, On-vehicle Service – Engine Oil Replacement P.12-4). • Engine Coolant Refilling (Refer to GROUP 14, On-vehicle Service – Engine Coolant Replacement P.14-6). • Drive Belt Tension Check and Adjustment (Refer to P.11C-8). • Fuel Leak Check • Side Under Cover Panel Installation (Refer to GROUP 51, Front Bumper Assembly and Radiator Grille P.51-2). • Front Under Cover Panel Installation (Refer to GROUP 51, Front Bumper Assembly and Radiator Grille P.51-2).

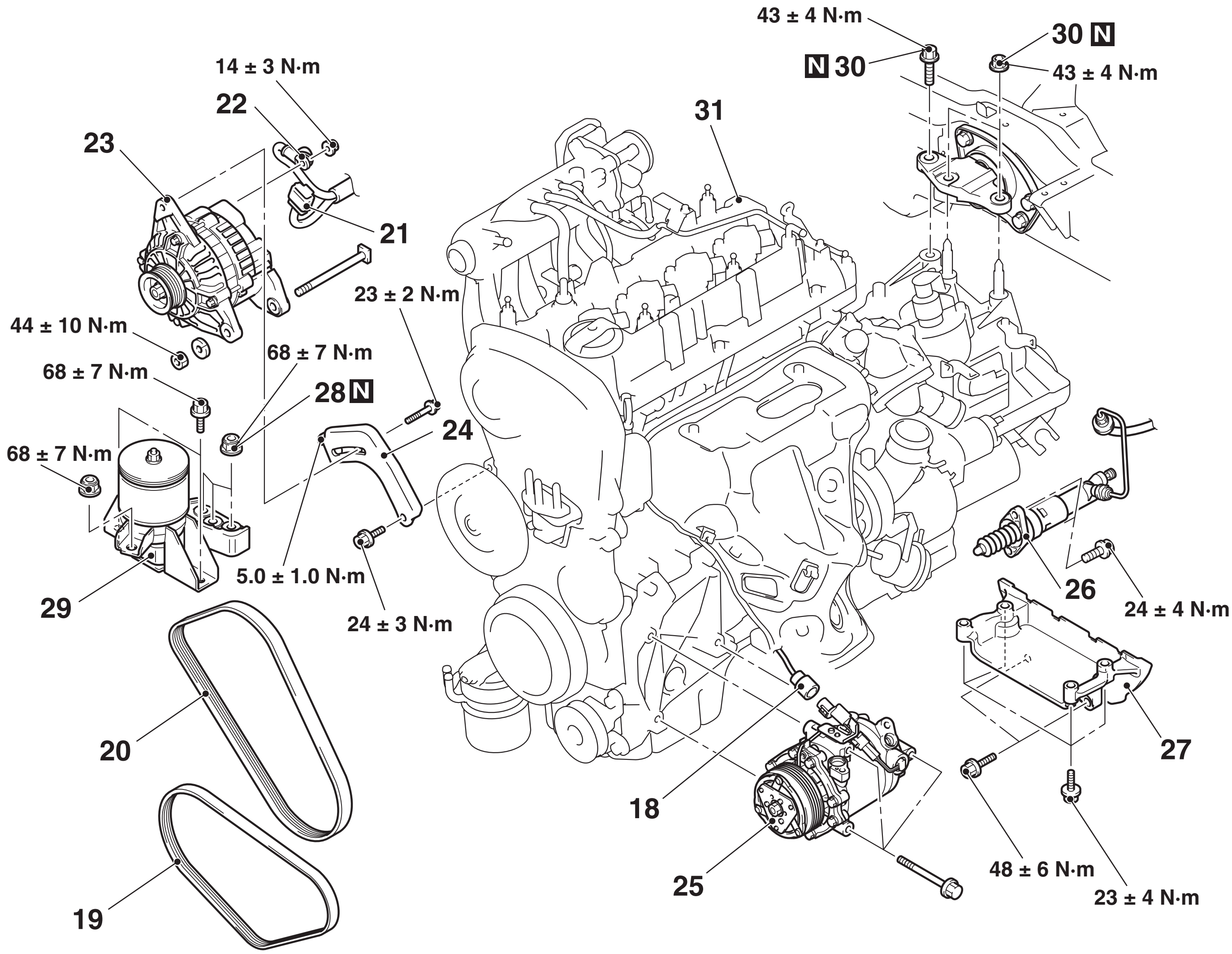
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			Removal steps
	>>E<<	•	Initialisation <Installation only>
		1.	Brake booster vacuum hose connection
<<A>>		2.	Gearshift cable and select cable connection
		3.	Earth cable connection
		4.	Fusible link box cover
		5.	Battery cable connection
		6.	Control harness connection
		7.	Control harness bracket
		8.	Earth cable connection

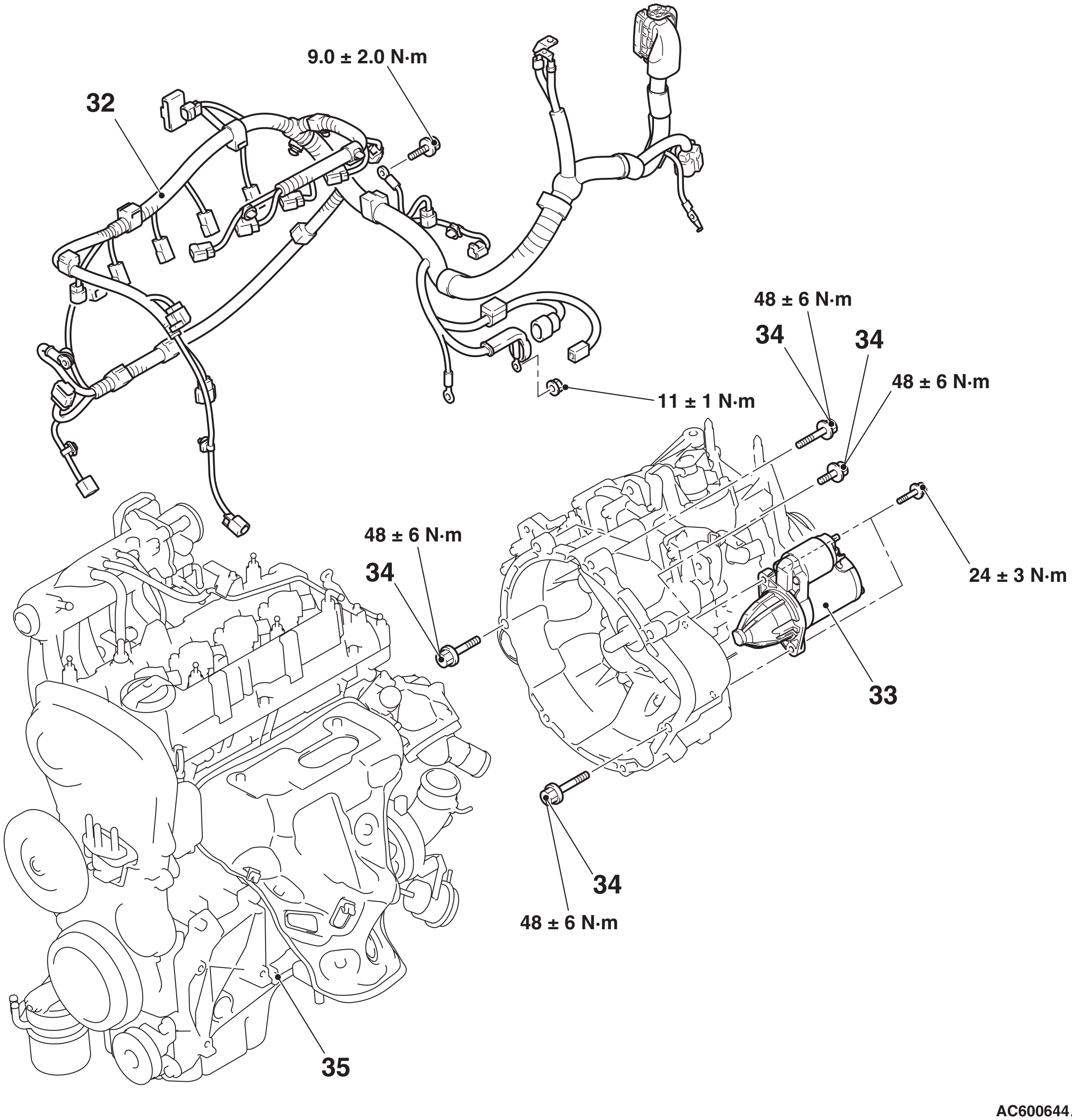
			Removal steps (Continued)
		9.	Engine-ECU connector
		10.	Engine-ECU
		11.	Fuel vapour control hose connection
		12.	Fuel hose connection
<<B>>	>>D<<	13.	Fuel high-pressure hose connection
		14.	Vacuum hose connection
		15.	Heater piping hose connection
		16.	Oxygen sensor connector
<<C>>	>>C<<	17.	Oxygen sensor

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		Removal steps
	18.	A/C compressor connector
<<**D**>>	19.	A/C compressor drive belt
<<**E**>>	20.	Alternator drive belt
	21.	Alternator connector
	22.	Alternator terminal
	23.	Alternator assembly
	24.	Alternator brace
<<**F**>>	25.	A/C compressor and magnet clutch assembly

			Removal steps (Continued)
<<**G**>>		26.	Clutch release cylinder assembly
	>>**B**<<	27.	Transmission housing front lower cover stay
		28.	Self-locking nut
<<**H**>>	>>**A**<<	29.	Engine mounting insulator
<<**H**>>	>>**A**<<	30.	Transmission mounting insulator connecting bolt and nut
<<**I**>>		31.	Engine and transmission assembly



Removal steps

32. Control harness
33. Starter assembly <<J>>

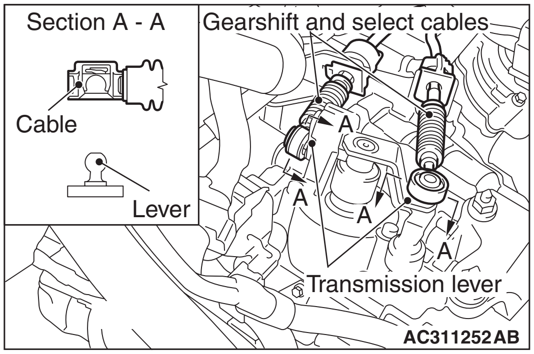
Removal steps (Continued)

34. Transmission connecting bolt
35. Engine assembly

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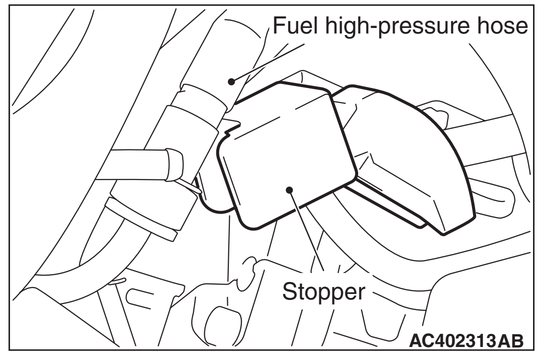
REMOVAL SERVICE POINTS

<<A>> GEARSHIFT AND SELECT CABLE DISCONNECTION

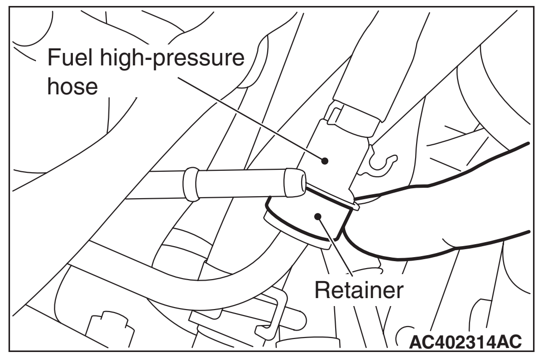


1. Disconnect the transmission assembly-transmission lever from the ends of the gearshift and select cables.
2. With the bracket installed, remove the gearshift and select cables from the transmission assembly.
3. After removing the gearshift and the select cables, tie them in a place where it will not be a hindrance when removing and installing the engine and transmission assembly.

<<B>> FUEL HIGH-PRESSURE HOSE DISCONNECTION



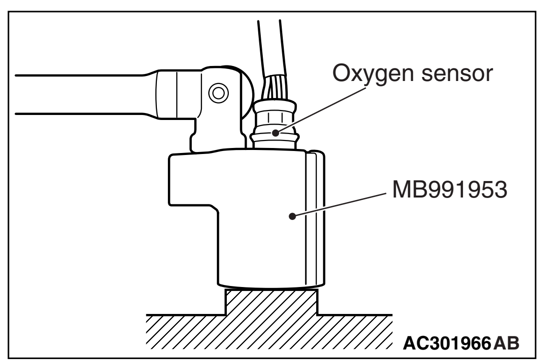
1. Remove the fuel high-pressure hose stopper.



2. Raise the retainer, and pull out the fuel high-pressure hose.

   NOTE: If the retainer is released, install it after removing the fuel high-pressure hose.

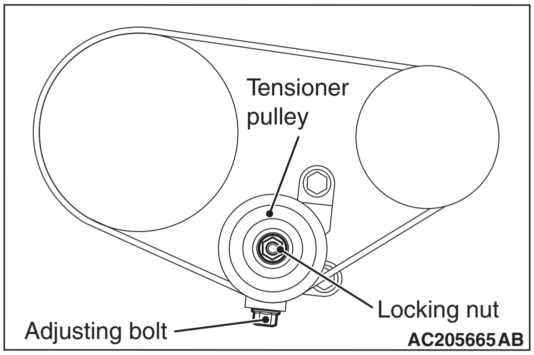
<<C>> OXYGEN SENSOR REMOVAL



Remove the connection and clamp of oxygen sensor connector, and then use special tool oxygen sensor wrench (MB991953) to remove the oxygen sensor.

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<<D>> A/C COMPRESSOR DRIVE BELT REMOVAL



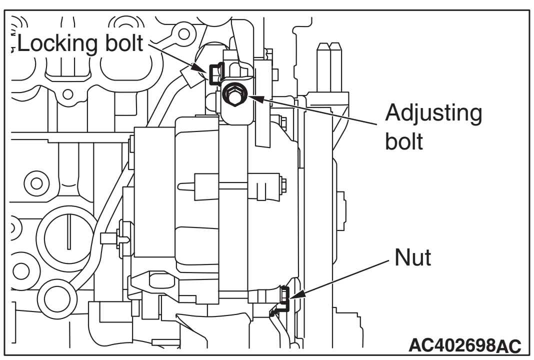
1. Loosen the locking nut of the tensioner pulley

⚠ CAUTION

To reuse the drive belt, draw an arrow indicating the rotating direction (clockwise) on the back of the belt using chalk, etc.

2. Turn the adjusting bolt in the anti-clockwise direction (to the left) to remove the drive belt.

<<E>> ALTERNATOR DRIVE BELT REMOVAL



1. Loosen the nut for alternator pivot bolt and locking bolt.

⚠ CAUTION

To reuse the drive belt, draw an arrow indicating the rotating direction (clockwise) on the back of the belt using chalk, etc.

2. Turn the adjusting bolt in the anti-clockwise direction (to the left) to remove the drive belt.

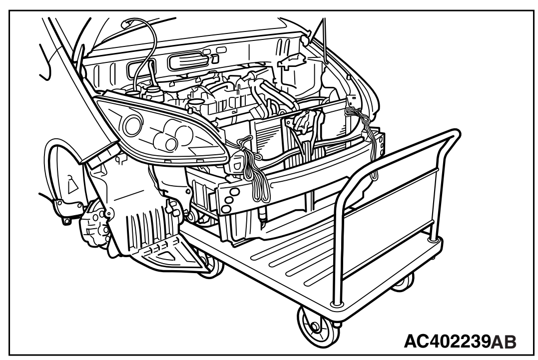
<<F>> A/C COMPRESSOR AND MAGNET CLUTCH ASSEMBLY REMOVAL

1. With the hose installed, remove the A/C compressor and clutch assembly from the bracket.
2. After removing the A/C compressor and clutch assembly, secure it with a cord in the location where the removal and installation of the engine and transmission assembly cannot be hindered.

<<G>> CLUTCH RELEASE CYLINDER ASSEMBLY REMOVAL

1. With the hose installed, remove the clutch release cylinder assembly from the transmission assembly.
2. Secure the removed clutch release cylinder assembly with cord or rope at a position where they will not interfere with the removal of the engine and transmission assembly.

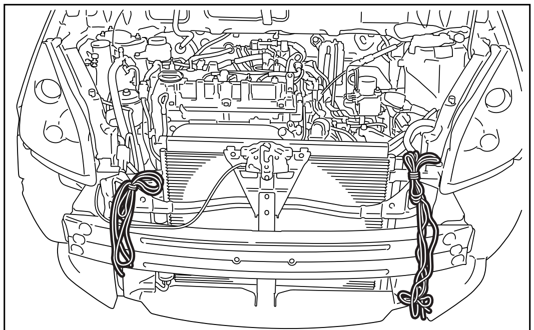
<<H>> ENGINE MOUNTING INSULATOR/TRANSMISSION MOUNTING INSULATOR CONNECTING BOLT AND NUT REMOVAL



1. Place a cart below the engine and transmission assembly.
2. Lower the lift to the position where the weight of the engine and transmission assembly is not applied to the engine mounting insulator and transmission mounting insulator.
3. Remove each coupling bolt and nut of the engine mounting insulator and transmission mounting insulator.

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<<I>> ENGINE AND TRANSMISSION ASSEMBLY REMOVAL



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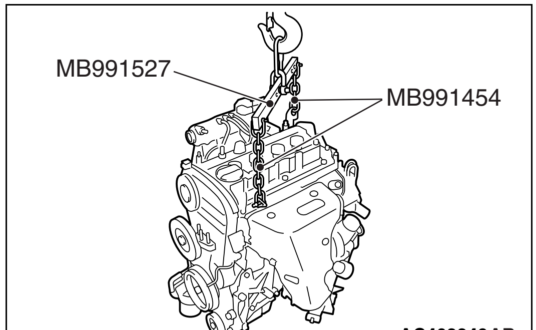
1. Secure the A/C condenser assembly to the front end panel with a code to prevent the A/C condenser from falling when removing the engine and transmission assembly.
2. Confirm that the cables, the hoses, and the wiring harness connectors are all disconnected.

⚠ CAUTION

Do not bend the fuel high-pressure hose.

3. Raise the body slowly with a lift, and remove the engine and transmission assembly.

<<J>> ENGINE ASSEMBLY REMOVAL



AC402249AB

1. Install the following special tools, and set a chain block.
   - Hanger (MB991527)
   - Engine hanger balancer (MB991454)
2. Remove the transmission assembly connecting bolts.

⚠ CAUTION

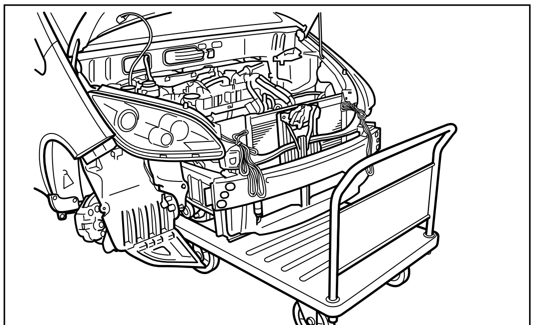
When lifting the engine assembly, operate with care not to lift the transmission assembly.

3. Lift the engine assembly slowly using the chain block, and remove the transmission assembly when the engine assembly is lifted a little.

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INSTALLATION SERVICE POINTS

>>A<< TRANSMISSION MOUNTING INSULATOR CONNECTING BOLT AND NUT/ENGINE MOUNTING INSULATOR INSTALLATION


AC402239AB

1. Place the engine and transmission assembly on the cart below the lifted vehicle.
2. Lower the lift to the position where the mounting bolts and nuts of the engine mounting insulator and the transmission mounting insulator are installed.
3. Install the mounting bolts and nuts of the engine mounting insulator and the transmission mounting insulator.

>>B<< TRANSMISSION HOUSING FRONT LOWER COVER STAY INSTALLATION

Install the transmission housing front lower cover stay as follows.

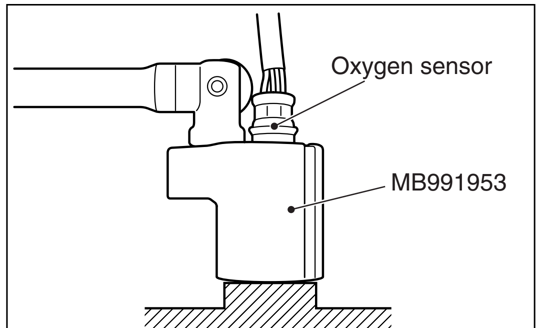
1. Tighten four mounting bolts of the engine side by hand.
2. Tighten two mounting bolts of the transmission side to the specified torque.

   Tightening: 48 ± 6 N·m

3. Tighten four mounting bolts of the engine side to the specified torque.

   Tightening: 23 ± 4 N·m

>>C<< OXYGEN SENSOR INSTALLLATION



AC301966AB

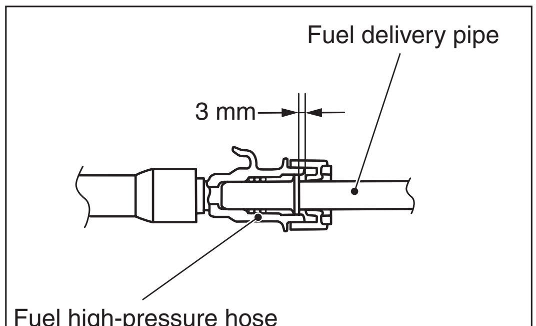
1. Tighten the oxygen sensor to the specified torque by using special tool oxygen sensor wrench (MB991953).

   Tightening torque: 50 ± 10 N·m

2. Connect the oxygen sensor connector and install the connector bracket.

>>D<< FUEL HIGH-PRESSURE HOSE CONNECTION

⚠ CAUTION



AC208465AE

After connecting the fuel high-pressure hose, slightly pull it to ensure that it is installed securely. Also confirm that there is a play approximately 3 mm. Then install the stopper securely.

Apply a small amount of engine oil to the fuel line pipe and then install the fuel high-pressure hose.

>>E<< INITIALISATION

When the engine-ECU is removed, initialise the electronic-controlled throttle valve system according to the following procedure after installing the engine-ECU.

Turn the ignition switch from "ON" position to "LOCK" (OFF) position, and then hold "LOCK" (OFF) position for approximately 10 seconds or more.